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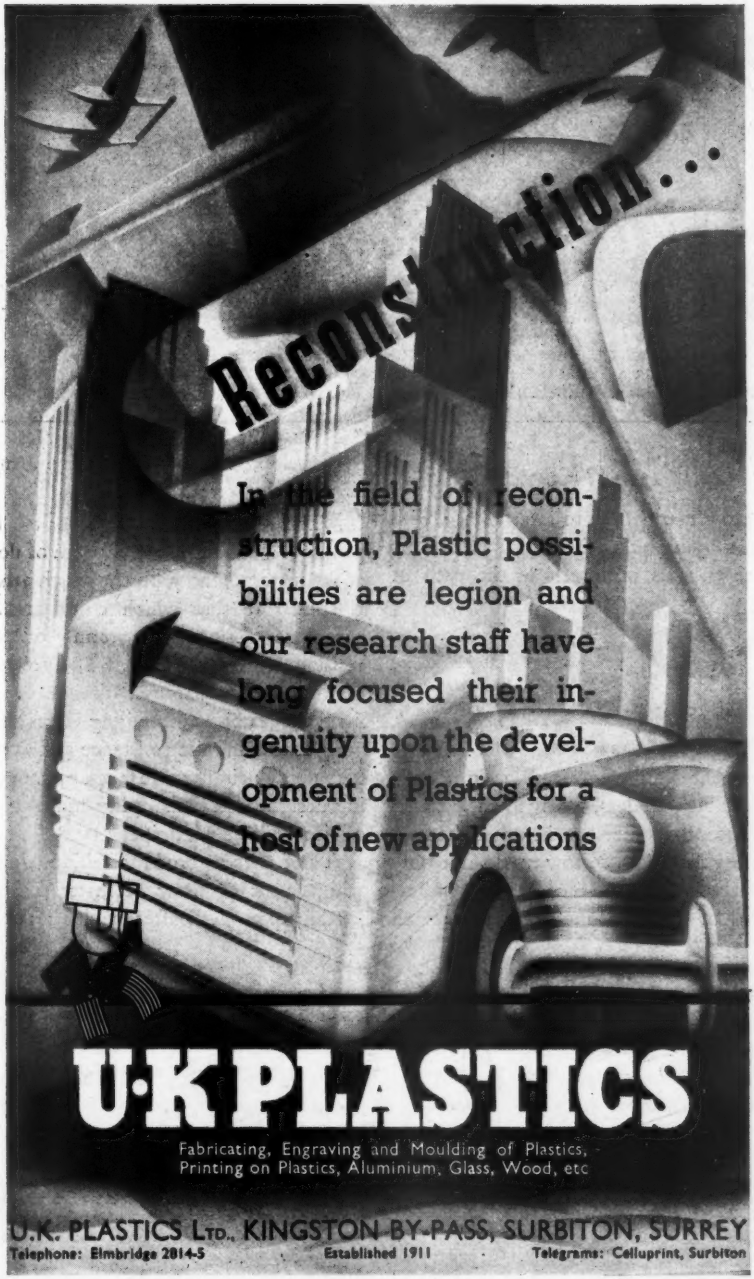
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A

Leaves from a Moulder's Notebook

THESE NOTES ARE THE FIRST OF A SERIES WHICH WILL DEAL WITH THE PROBLEMS ENCOUNTERED BY THE MOULDER AND DESIGNER. THEY REPRESENT THE EXPERIENCE OF THE B.I.P. DEVELOPMENT DEPARTMENT, AND B.I.P. HOPE THAT READERS WILL RESPOND WITH THEIR OWN IDEAS AND ENQUIRIES.

Flow Marks—1

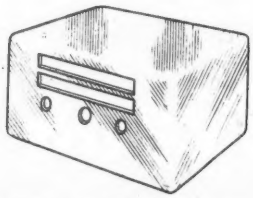
Flow marks (due to interference with the moving bulk of material caused by corners, slots or inserts in the path of flow) are more noticeable in Beetle moulding powders, owing to their translucence, than they are in other thermosetting materials. Flow marks not only detract from appearance, but are indications of local weakness which threaten to develop, after a year or two, into slight ageing cracks.

Fig. 1. True Aerofoil Form—Showing Air-flow Lines.

Fig. 2. Truncated Aerofoil Form—Showing Turbulence set up as a result.

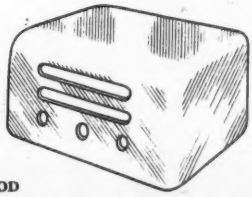
When slots or inserts have to be positioned in a mould in the path of flow of the material, the problem which arises is similar to that which confronts an aeroplane designer in terms of air resistance (Figs. 1 and 2). The greatest care is taken in aircraft design so to form the leading and trailing edges of a wing as to minimise resistance and avoid turbulence; similar care taken by moulding designers in the shaping and placing of slots will be well repaid.

A slot with a broad "trailing edge" will prevent the flow of material from joining up properly after the slot has been



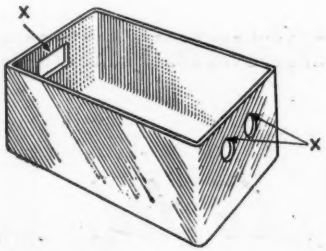
BAD

Fig. 3. Slots are too near top edge and too square. Slots and holes are unbalanced. Flow is invited towards bottom of cabinet and flow marks will result.



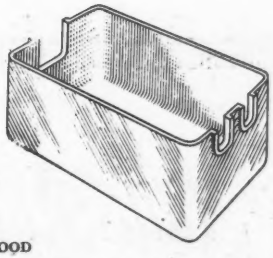
GOOD

Fig. 4. To avoid impeding flow, the slots and holes are balanced; the slots are rounded, wider spaced, and not too near the top edge which has been given a large radius. Any flow marks will respond easily to moulding control.



BAD

Fig. 5. This design will lead to flow marks at "X."



GOOD

Fig. 6. Complete avoidance of flow marks by running slots out to edge. This design reduces tool cost and speeds up moulding.

passed, and will cause flow marks which may well lead to cracks, whereas if the slot can be streamlined (or, better still, if it can be designed to run out to the side of the moulding, so that there is in fact no "trailing edge") the difficulty will not arise. Figs. 3 to 6 explain how this danger may be countered in practice by the designer.

In the case of the round lid with "cut outs" the design could not be modified, and the problem had to be tackled another way. As slow movement of material was necessary in order to allow time for "joining up," a flow-control-valve was used; this brought about 95% cure of flow marks, but considerably slowed up production (Figs. 7 to 9).

To summarise, slots and other inserts:—

(a) should be streamlined.

(b) should be placed to interfere a little as possible with flow.

(c) should not be too near a corner which causes change of direction of flow, as this would provide an additional hindrance to "joining up" after the slot is passed.

(d) should be given balanced positions, to permit the balanced flow of the material.

It is clear that not only the moulder but the designer must contribute to solve the problem of flow marks, which is likely to receive increasing attention as the present demand for colour adds to the popularity of Beetle moulding powders.

Fig. 7.

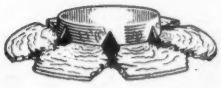


Fig. 8.

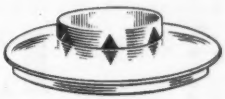


Fig. 9.

Figs. 7 and 8 are "short" mouldings showing break in flow owing to "cut outs" in the vertical cylindrical wall. Fig. 9 is a good moulding resulting from a correct but slow moulding process.

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Cross-breaking St'gth (lb./sq. in.)	29,000	14,000	19,000
Impact Strength (ft./lb.)	5	2.5	4
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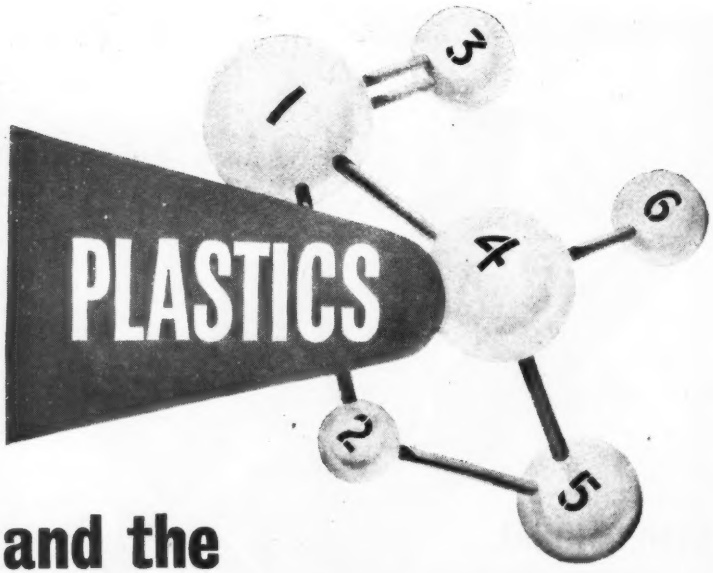

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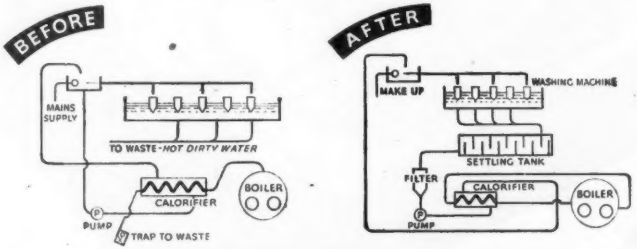

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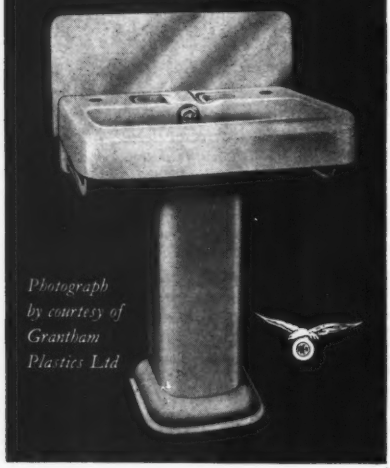

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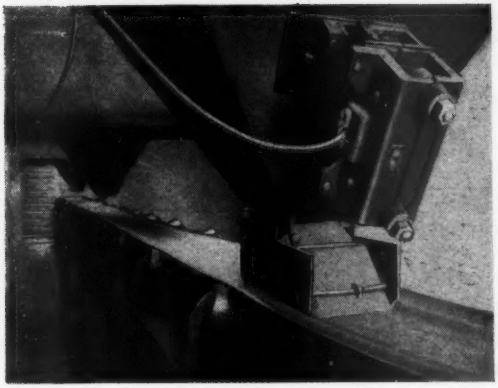

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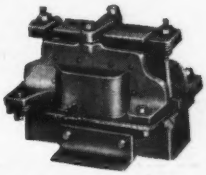

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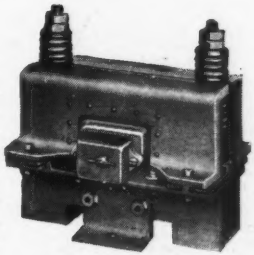

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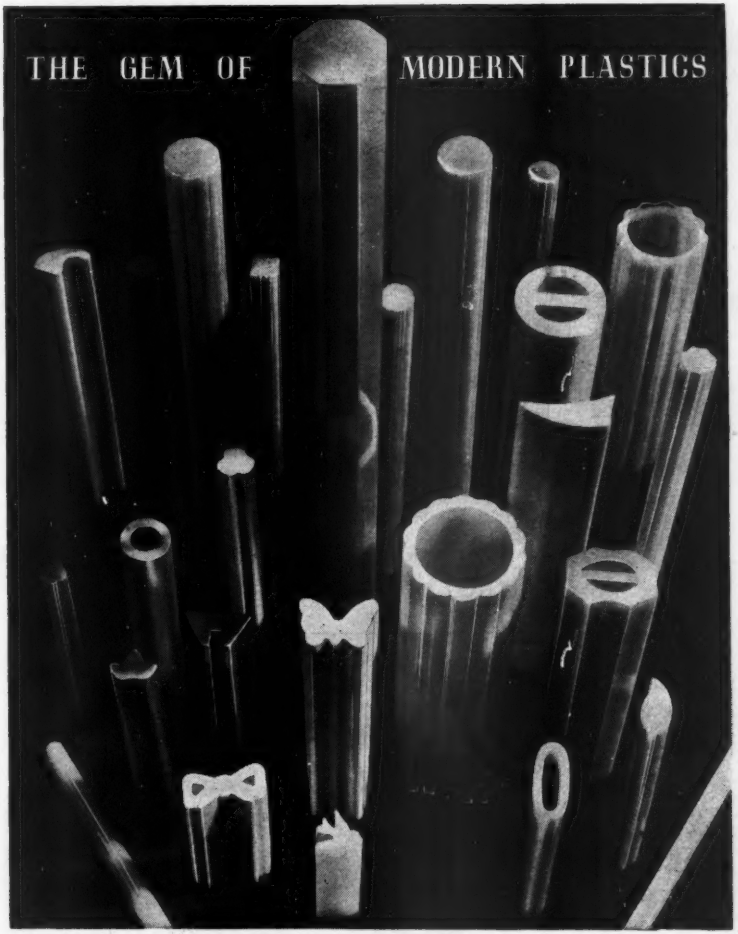

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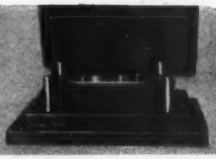

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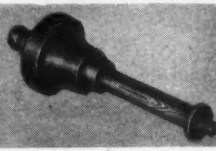

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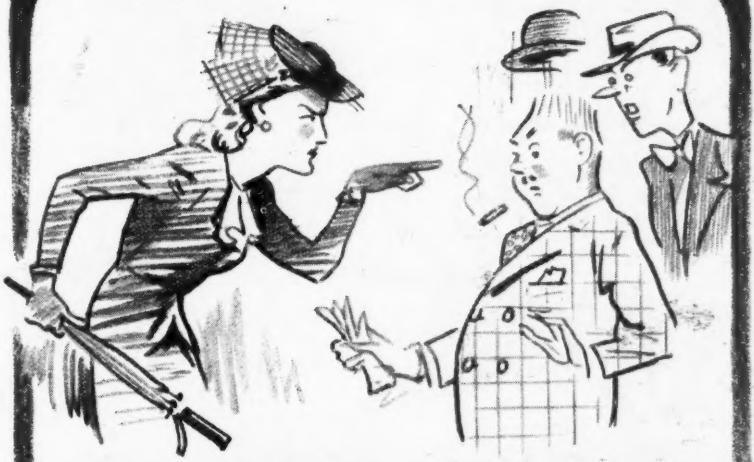

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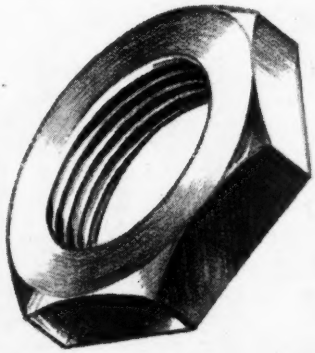

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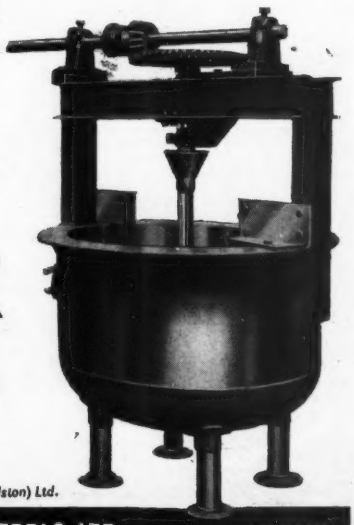

"Staybrite" steel jacketed pan of 100 gallons capacity for moulding powders, tested to a pressure of 100 lbs. per square inch.

Photo by courtesy of Thompson Brothers (Bilston) Ltd.

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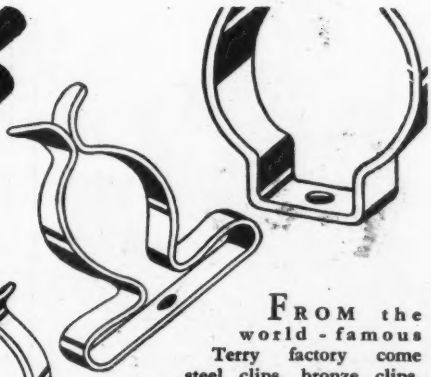

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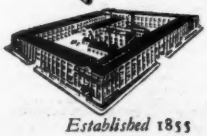
by TERRY SPRINGS



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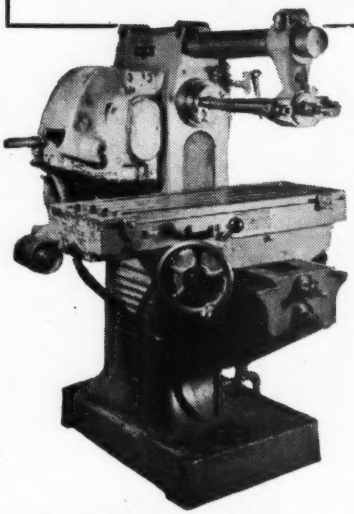

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LONDON: Room 0088, Ground Floor, Thames House N., Millbank, S.W.1
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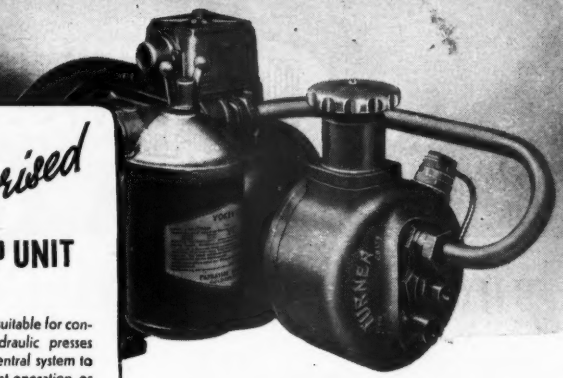

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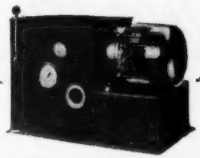

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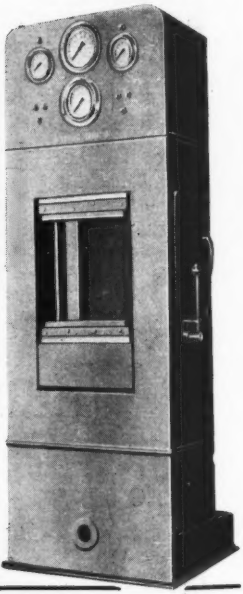

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1. **PORTABLE OR FIXED UNITS** embody endless belt, belt tensioner and belt drift corrector. Unit by unit the MotaVeyor can be extended to any length.
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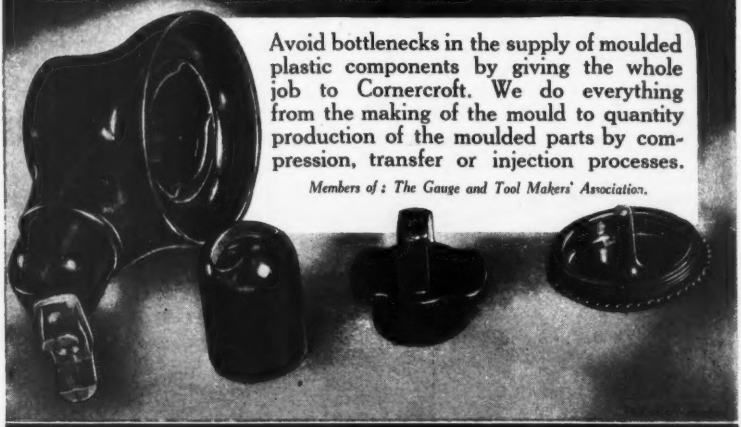

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★ Buttons, even such beauties as these, do not, of course, grow on boughs. They are just one of the countless products that can be made from BX Thermo Plastics.

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Vol. X. No. 115. DECEMBER, 1946.

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - TEMPLE PRESS LIMITED
Managing Director - ROLAND E. DANGERFIELD

Editor - - M. D. CURWEN, B.Sc., A.R.I.C.
Offices - Bowling Green Lane, London, E.C.1

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NOTICES

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EDITORIALS

Highlights of the Exhibition

ABOUT 52,000 people saw the "Daily Graphic" Plastics Exhibition at the Dorland Hall, in London, between November 7 and 27, being an average of 3,000 each day.

What were the highlights of the exhibition? Well, as the Professor might say, it all depends on the onlooker, and most people would give different answers. We must take it for granted, we presume, that to be a highlight the object must be new to the observer, so that obviously to some almost every object may have appeared beautiful, exciting, novel, outstandingly important, or what you will. Thus, to a manufacturer, a plastic gear-wheel may have been completely novel and of tremendous urgency, the moulded melamine tray may give an ecstatic thrill to a "Nippy," and the kids scream with delight at Hilary Page's toys. To us, however, who met the plastic gear some time in 1936 and the tray and the toys during the war, the glamour is somewhat dimmed, although not our admiration. So too with the "Rockite" extruded tubes of thermosetting resin which acted as guardian pillars to one "shop-window" and which can be used as towel-rollers or table-edging according to the cross-section desired; the tooth or industrial brushes of nylon, that wonderful filament of modern chemical science; or the lovely printed p.v.c. which every woman knows.

Our own predilections incline to the technical as well as the new. It may sound strange, but our heart stopped a beat when we saw the polythene bucket, for we and a hundred thousand industrial chemists the world over have long been dreaming of such a container that strong acids will not eat through. We regard also the Holoplast structures as something really important in the 20th century, not so much because it makes a beautiful table top, but much more because it can be made into a strong yet light bulkhead or door for a ship or house, to eliminate or lower the fire risks of our existence. Then there are the small things that fascinate us sometimes because of their intrinsic beauty, but more often because we think of the ingenuity in the manufacturing technique behind it all. Thus we open our eyes in wonder at the British Celanese sequins made, we suppose, from extruded cellulose acetate; at the tiny violin cut from methyl methacrylate and engraved with tiny jewellers' tools; or casein buttons that have changed in colour and wonderful design four times a year for the past 50 years.

Shall we ever stop admiring the multi-coloured extruded p.v.c. that Mr. Veit has given us to make our braces or our ladies' shoes, the laminated table tops of Warerite that "nor worm nor rust defile," or the strongest suitcase we have ever handled, pressed from impregnated fabric? No, there's not much need or object in pointing out what we liked especially. They were very, very good.

Plastics Centre

IN the heart of the City of London there stood, until Goering's noble fellows got busy one night in 1941, a "House of Plastics," which belonged to BX Plastics, Ltd., and which served as its showroom. We often visited it to get ideas and to palm them off as our own to the unsophisticated.

How often in recent times we have hoped that a bigger and more comprehensive "House of Plastics" existed, where all moulders and fabricators could exhibit their several products!

The Plastics Exhibition has, as we have said, been a great success. It has shown the need for teaching the public what plastics really are. More than ever then is it necessary to strike while the iron is hot and to keep up a propaganda that is vital to the well-being of the industry,

but also more than ever is it necessary to tell the buying world where to get the objects and materials they hear so much about. And here we are not so much thinking of the public itself but of a section of it that has grown up in the last century or more and that has contributed greatly in the past to the economic welfare of the Empire. We refer to the vast number of merchants that exist here, representatives, buyers and agents of tens of thousands of distributors, who know little or nothing about our products.

We in this office are at the receiving end of an unceasing and indeed growing flow of inquiries, and can bear ready witness to an increase in demand that needs careful guidance and sifting.

In the heart of the West End of London there also stood, until Goering's noble fellows got busy in 1941, a Building Centre which served as a clearing house for the building industry. Those who knew it, also knew of the enormous service it gave not only to the thousands of building agents and merchants in the country, but also to the public who wanted to know the latest materials and ideas that had been forthcoming. The building industry knew its value too and the Building Centre continues to carry out its mission elsewhere.

In the 1930's the woollen industry was in rather a messy state, and buyers from all over the country and from abroad were forced to scrape together their information in divers ways and waste valuable time in visiting individual firms. A famous statistician advised the Bradford Chamber of Commerce to get the interested concerns together, to sink competitive jealousies and to form a centre in the heart of Leeds where buyers could see all they wanted. This, we believe, was done and that nobody has regretted it.

Many years ago in these pages we advocated the creation of a Plastics Research Institute. We have never ceased urging its necessity, but if a choice were forced, because, let us say, of lack of money, between such an institute and a Plastics Centre, we think to-day we would plump for the latter.

Revival of Horn Plastics

ARTICLES of genuine horn seem to have disappeared from our ken, which is a great pity. Their manufacture was a much-appreciated art by the cognoscenti, and buttons, combs and the like were much sought after for their beauty, their strength and their great durability. We last saw some lovely specimens, drinking jugs, tumblers and the like, on the stand of Aberdeen Combworks, Ltd., at the 1938 Empire Exhibition, Glasgow. We hope this did not see the end of one of the oldest of English arts.

Production was, of course, widely spread throughout Europe, and one amusing side of it was revealed in the "Fugger Newsletters," we believe, when one of the famous merchant prince brothers of the 15th century exposed the fabrication of "genuine" unicorn horns by an early racketeer.

We are reminded of all this because we have just seen examples of a new little industry that might well be called the modern version. The process consists in the extraction of the keratin (the protein matter in natural horn), its conversion into a white powder, and the use of it as a moulding material for manufacture into buttons and other objects by moulding.

The production has been carried out for several years in Czechoslovakia with great success, and one expert now in this country is on the eve of travelling to India to set up a model factory there. He tells us that the moulding powder is produced at an equivalent of about 10d. per kilogram (4½d. per lb.), and is moulded at 150 degrees C., under a pressure of ¾ to 1 ton per sq. in., which is not very different from normal pressure moulding practice.

Since button manufacture from casein, methyl methacrylate and urea resins has grown so greatly in this country during the war, it seems a pity that this new process has not been introduced too. Certainly we cannot afford at this juncture to reject such an excellent raw material to eke out the world shortage.

Next Step in H.F. Heating?

WHEN Mr. G. Dring, of Bakelite, Ltd., gave his lecture on the heating of synthetic resin powders by high-frequency current prior to moulding, we quite rightly hailed the process as one of the most important advances since moulding was first carried out. Its advantages, resulting in improved curing and more rapid curing, were obvious, and to-day the process has been very widely adopted here and throughout the world.

Concurrently, the world of plastics took note of the welding of thermoplastic sheet, using the same source of heat, and while, theoretically, there was here even a greater field than that among the thermosetting resins, yet there has not been wide adoption at all. Obviously, the conditions and machines are vastly different, and it may be that the problems involved in, say, welding a thermoplastic waterproof coat to replace stitching may never be economically solved.

However that may be, there is one aspect of H.F. heating that we hope will be the next endeavour of the designers of the machines and which we consider of outstanding importance. It is the use of high-frequency current for the through pre-heating of thermoplastic powders and masses for the injection, extrusion and calendering processes. Ease of flow and less expenditure of mechanical energy, diminution of "scorching," evenness of production, absence of unfused particles and consequent improvement in appearance should prove to be some of the results of such an adoption. Obviously there would be no small difficulty in designing a plant for rapid or continuous pre-heating of the large quantities used for these jobs. For extrusion and injection, new feeding conceptions may be needed, and for calendering the difficulties may well be insuperable for many years, but the improvements in quality that would certainly ensue make the whole matter worth tackling.

1946 OFF WITH THE OLD — ON WITH THE NEW 1947

A MERRY XMAS and A PROSPEROUS NEW YEAR

Keep Your Powder Dry

WE suppose that a middle-aged historian of industry with a bent for seeing the changes in small things as well as the big ones, would point to packaging as being one of the striking and interesting developments that have taken place in the past 50 years.

We well remember the fascination in our childhood of watching the village or town grocer, with an enormous rusty handsaw, sawing up penny and twopenny blocks of salt from a great parallelopiped of the stuff. We remember also the curious mechanical chopper he employed for producing cubes or "near" cubes from long conical sugar loaves that have now disappeared for ever. Myriads of weighable material—tobacco, currants, sweets, rusty nails and fish (you can add what you like to this list)—were man- or woman-handled in a way we now rightly regard with extreme distaste. To-day nearly everything is packed in paper, cardboard, wood, metal or plastic, and that fact we look upon, with sufficient good reason, as a sign of our highly civilized life.

Until recently, however, the job had been only half done. Any paper package is better than none for keeping the aforesaid materials clean until they reach the customer, and any prettily designed and coloured package is said not only to be good sales talk, but one conveying considerable uplift of morale, especially if the recipient is a female and the contents of the package a pair of what are now ubiquitously called "nylons."

But, as we say, this is only half the job, and the completion of it is now with us by the provision of paper and cardboard that really protect the contents from attack by moisture, oil, acids, alkalis, and what you will.

The next step taken was to provide paper or cardboard container with a coating of wax—generally paraffin wax—which has outstanding characteristics from the water-resisting point of view. All of us have seen the waxed paper or waxed cardboard type of container, for holding anything from salt to ice cream. This, indeed, was a memorable advance,

and the process, applied especially to waxed textile, was used considerably during the war for the protection of much valuable munitions of war. The great fault of such waxed materials, however, lay in the inherent weakness of the wax, i.e., its very feeble mechanical strength.

The problem has been finally solved by the coating of paper and cardboard with very highly resistant films of plastic, films that are tough and strong, although extremely thin. Manufacture in this country began before the war, and grew enormously during the war for applications of exceptional high priority, such as the protection of valuable machinery, aircraft components, photographic materials and foodstuffs, in transit or in storage on all battle fronts of the world. More especially useful were such treated papers and bags for material sent to India, Burma, Malaya, and other points East, where rot and rust played havoc with everything.

It was during the war that we visited one of the best known of the factories producing such treated paper—Leonard Stace, Ltd., of Swindon Road, Cheltenham, Glos—at a time when nearly 100 per cent. of the production was produced for the Services.

Returning recently to these works to note progress, we were most interested in the development in the change-over to peace-time production. The company employs a specially designed polyvinyl cross-polymer as the coating material, which has proved outstandingly high in performance on testing for moisture-, water- and petrol-resisting tests, while the ingenious coating methods and coating machinery deserve special description themselves.

What was also remarkable was the new variety of papers and cardboard now available. The strong Kraft paper is coated for industrial jobs, and cardboard is treated to make the stiffer type of container perfectly resistant. Since the coating can be coloured in pastel or other shades, we can now obtain the æsthetic-looking protective in one and the same film.

Perhaps most important of all, Leonard Stace, Ltd., also coats paper on both sides, so that the heat-sealable bag is now a real fact and available commercially. It means that valuable samples easily affected by moisture can be readily, safely and cheaply sent through the post, after running a hot iron round the free edges so that plastic adheres to plastic completely and strongly.

For the chemical industry this development should prove an immense boon for the carriage of hygroscopic powders or crystals of which there are so many, especially those of the type of zinc, calcium and cerium chlorides which turn completely to liquids on exposure to air in absence of adequate protection.

Probably the greatest virtue of this plastic coating for paper lay in the fact that its waterproofness and crease resistance is in no way affected when the paper is reversed and creased and folded, even under heavy weights. The makers claim that probably no other paper has this notable feature.

At the moment, "Cellophane" cannot be coated because there is no adhesion between this material and the copolymers which are used. However, it has been found that, by coating regenerated cellulose it is possible subsequently to strip the film very easily, and this appears to be a novel and quite cheap method for producing a copolymer film which combines transparency, solvent resistance and heat sealability.

There is one other point which it seems desirable to mention, and that concerns paper shortage, which to-day is more severe than at any time within memory. Leonard Stace, Ltd., inform us that they have actually been refused paper for direct Ministry of Supply contractural work, and consequently they have (at the moment) to undertake the coating of papers which are actually available from the customer's own sources of supply.

On our correspondence page we include a letter from Leonard Stace, Ltd., which refers to another very interesting application of coated sheet.

Rubber Bonding and the Plastics Industry

By T. W. MALDEN

The technique of bonding natural and synthetic rubbers to metal and other rigid materials has made it possible to employ rubber in many new applications which utilize the unique properties of these non-rigid materials more fully than has been possible before. It is with the object of stimulating interest and inquiry into bonding processes, and their extension to plastics other than rubbers, that this article has been written.

THE processes in use for bonding rubbers to metal and other rigid materials can be broadly divided into those giving a chemical bond between the rigid and non-rigid material, and those giving mere physical adhesion which may, nevertheless, be quite effective for its purpose. The choice between the two methods may be dictated by questions of cost, but for technical reasons alone there seems no doubt that chemical methods are generally preferred. There may be some difference of opinion as to whether a particular process is chemical or physical in nature, but the classification adopted below is widely accepted at the moment.

The majority of physical methods depend on proprietary materials, the composition of which is not in all cases disclosed. Further, as materials exist other than those mentioned, their omission is not intended to reflect on their efficacy.

CHEMICAL PROCESSES

The Brass-plating Process

Up to now this method seems to have given the most consistent results and is in use in this country, on the Continent, and in the United States, where it has been developed since 1926. It consists in vulcanizing rubber in contact with brass of about 70/30 composition and alpha structure, under heat and pressure. The brass may be solid, or an electro-deposited layer, and the temperature between 250 and 320 degrees F. under normal platen pressures. Bonding is effected in about 10 minutes at 360 degrees F.

Any material to which brass-plating will adhere can be bonded by this method, which can therefore be employed with plastics and other non-conductors plated by the recently developed techniques.[1]

The bonding agent is probably the sulphur used for vulcanizing the rubber, which forms sulphide linkages between the copper of the brass and the double bonds in the rubber.[2] Support is given to this view by the fact that saturated synthetics (e.g., p.v.c.) cannot be bonded by this or analogous methods.

The process is effective with natural rubber, Neoprenes (poly-chloro-isoprenes), GR/S and Buna S (butadiene-styrene co-polymers), Buna N and Perbunan (butadiene-acrylo-nitrile co-polymers), and Butyl rubbers (poly-butenes). The bond is resistant to oils, to heat up to about 170 degrees C., and considerable dynamic fatigue, and gives a tensile strength of up to 1,200 lb. per sq. in. It is resistant to ageing as much as the rubber itself, but can be broken down by bimetallic corrosion such as occurs in sea-water.

Other Metallic Interlayers

It would seem reasonable that other metals which readily form sulphides would be effective bonding agents, and this view was put forward by Weber. However, in actual practice this is not the case, although some success has been achieved with certain forms of chromium and cobalt.

It appeared at one time that a rival to brass had been found in so-called "black-nickel" plating,[3] but the process

does not seem to have been developed on a commercial scale.

Desmodur R

Another approach to chemical bonding seems to have been made by the introduction of Desmodur R in Germany during the war.

Chemically this material consists of methane triphenyl tri-isocyanate. It was developed originally to secure better adhesion between Buna S and rayon cords in tyre making, and it is further claimed to bond natural and all synthetic rubbers, not only to rayon but to all metals and some other materials. The mechanism of its action is obscure, but as it attacks metals and is also an accelerator of vulcanization of rubber, the bond is presumed to be a chemical one.

Desmodur R is simply applied to a clean metal surface in the form of a dilute solution in methylene chloride, and the rubber vulcanized in intimate contact with the treated surface. Good results are also said to be obtained by mixing a small proportion of the Desmodur R in the material to be bonded.

PHYSICAL PROCESSES

Ebonite

The oldest process for bonding rubber to metals is the so-called " ebonite junction " process. A layer of ebonite or " hard rubber " is interposed between the bulk rubber and the metal, and the whole is vulcanized together. The bond so obtained is thermoplastic, and on irregularly shaped objects it is difficult to ensure that the ebonite will remain in place. At one time when solid tyres were in vogue they were all made by this method, and it still has a limited application in tank linings. It has been claimed that the high sulphur content of the ebonite layer affects a chemical bond with steel or iron, but this is doubtful, especially as in most cases the ebonite can easily be detached.

Chlorinated Rubber

Chlorinated-rubber cements have been used for bonding Neoprenes to steel and light alloys, and it is claimed that adhesion is improved by the addition of red lead to the chlorinated rubber.[4] The cements are applied to the metal parts and the Neoprene vulcanized in contact with them. The process does not appear to have been carried out extensively, and has largely been superseded by proprietary adhesives of the rubber-derivative type.

Rubber-derivative Cements

There are a large number of proprietary adhesives derived from rubber. They include the Ty-Plys and Vulcabonds. The forerunner of these was the Goodrich Vulcalock process employing cyclized rubber, and the original Ty-Ply was another rubber derivative, namely, rubber hydrochloride.

Such materials are simple to apply and give high bond strength, but in most cases the bond is thermoplastic and ruptures easily under shock loading.[5] However, improved compounds are offered from time to time, and it is possible that in the future similar materials will give results as satisfactory as those now obtained by the brass bonding technique. With one or other of the materials now available, natural and synthetic rubbers can be bonded to most ferrous and non-ferrous alloys, and to wood, laminated bakelite, carbon and other substances.

Resin Adhesives

A number of bonding agents are based on various thermosetting resins, although their precise composition is not always disclosed. Most of the adhesives which are effective in adhering vulcanized compounds to metal are of this class. They include the Cycloweld process Reanite, the Durez resins, and the well-known Redux process, which was developed for bonding metals together without riveting which has been used in such constructions as airframes.

Practically all such materials require heat and pressure to effect a bond, and the results are resistant to at least the same degree of heat as employed for

bonding, and usually to oil and other solvents. There are undoubtedly great possibilities in this field which are now being investigated.

APPLICATIONS

Bonded articles fall into five main classes. Besides these, there are a large number of other applications which do not fall into this broad classification. The last three groups are most likely to interest those working with plastics other than natural and synthetic rubbers.

(1) Flexible couplings.

(2) Anti-vibration mountings.

(3) Sealing devices.

(4) Electrical fittings.

(5) Protective coverings.

Flexible couplings are made in a variety of types, and are designed to transmit up to 3,000 h.p. They are used in marine propeller drives, motor generators, car transmission shafts, aircraft magneto drives, aircraft auxiliary drives, and as diesel-engine crankshaft dampers, or elsewhere, to overcome torsional vibration.

Mountings are employed widely for machine mountings, aircraft instruments, car, aircraft and marine-engine suspensions, car-body mountings, and for mounting all kinds of fittings on ships.

The variety of sealing devices which are now in production is enormous and many uses for plastics other than rubber can be visualized. Such seals are used in pumps, pipe couplings, watertight seals on radio sets, shaft seals for engines and pumps of various kinds, and self-lubricating seals incorporating carbon or sintered metal.

Uses in the electrical industry are increasing rapidly. Various types of plugs and sockets are made, some of them having a shroud bonded to the sheath of the conductor to give a gas-tight fitting.

FUTURE DEVELOPMENTS

Bonding techniques have been developed, namely, in rubber and similar materials, but already the wider field offered by other plastics is receiving attention.

The desirability of securing a bond to metal inserts in plastic moulding has been noticed and coatings of Neoprene or Vinylite recommended for the purpose,[6] but this provides an expansion joint rather than a true bond. In some cases such a joint may be useful in taking up differential expansion. The high temperature resistance of the Silicones has a value which would be enhanced if the materials would be bonded to metal in the form of seals, valves and packing rings, and, so far as is known, no means of effecting this is yet available.

The increasing use of polythene in the electrical industry has drawn attention to the need for providing secure and stable anchorage between the plastic and metal.

A rival to the Redux process has appeared in the Metlbond adhesive, which is a combination of the two materials. One is flexible and is based on synthetic rubber, and the other has a plastic base. It is claimed to give a chemical bond, and has been used for bonding aluminium to Fiber-glas or Plexiglas, or even aluminium to steel.[7]

It is possible, and desirable, that there should be a means of bonding all plastics to metals and to other materials, such as glass. When this is achieved plastics will find still wider fields of application in the motorcar, radio and domestic equipment industries.

REFERENCES

(1) "*Metal Ind.*," 1945, 67, 384. (2) *Trans. Inst. Rubber Ind.*, 1946, 21, 342. (3) "*Activato*," 1936, 2, 44. (4) *Trans. Inst. Rubber Ind.*, 1937, 13, 136. (5) *Trans. Inst. Rubber Ind.*, 1945, 21, 276. (6) "*Modern Plastics*," 1946, *Jan.*, 142, 192. (7) "*Iron Age*," 1945, *Jan.*, 62.

THE BOARD OF TRADE announce that the Standards Department has left Boots Hotel, North Promenade, Blackpool, and is now at Chapter Street House, Chapter Street, London, S.W.1 (telephone, Victoria 7032).

The Plastics Designer in Action

By F. E. Middleditch, M.S.I.A.

The occasion of the "Britain Can Make It" Exhibition prompted the Society of Industrial Artists to hold a Designers Conference at the Victoria and Albert Museum, October 12-13. Mr. F. E. Middleditch, chief designer, De La Rue Plastics, Ltd., dealt with the subject of plastics. By joint permission of the speaker and the Society of Industrial Artists, we give the case for "the designer in action" as presented by Mr. Middleditch.

AT the moment the demand for plastic articles is so great, and the supply of raw materials is so limited, that it is possible to satisfy only some of the inquiries from outside sources. Within the limits imposed by these abnormal conditions, it is endeavoured to improve design and likewise to improve manufacturing processes. Yet, from the designer's point of view, it is unfortunate that at a time when a determined effort is being made to improve the design of British manufactured products, the plastics industry is seriously limited by shortage of raw materials, especially those materials which are light in colour.

Inquiries from outside sources are dealt with in this way: The sales manager, who first receives them, sets aside those which call for attention in matter of design, and the designer is invited to consider them. At this informal discussion it is decided whether the project is a moulding proposition, and whether mould making and moulding capacity will be available. As it seldom happens that the inquiry is clear cut, the designer then arranges to see the customer to elicit precise information on what his needs really are.

Assuming the necessary information has been obtained, the next step is to think about it. The facts are reviewed, the irrelevant ones discarded and vital ones are set down in order of importance. With pencil and paper, or with "Plasticine," perhaps both, the first tentative essays in form are built round the conditions, so to speak. Some sort of linear record is always made and kept, because frequent reference to first ideas is found to be a valuable aid to self-education. On the other hand, three-dimensional sketches are often the only way to work out an involved form, especially where several free curves have to be blended.

After a time the germ of a satisfactory solution is found, and at this stage the design ceases to be a solo performance. A perspective sketch and explanatory diagrams are therefore prepared and discussed with other members of the organization. Every opinion is encouraged and each point talked out to a conclusion. It now becomes obvious that the designer holds the balance between the customer and the factory. He has talked with the customer and has become familiar with his point of view. Long and intimate association with the factory has also taught him the essentials of the moulding process.

Having originated his solution to the design problem, the designer therefore invites criticism and suggestions from representatives of the factory. He accepts any reasonable suggestion that will simplify the manufacturing process, but will not entertain suggestions that lessen the effectiveness of the product from the customer's point of view.

The usual practice now is to draw up more detailed perspective drawings and explanatory diagrams which are frankly realistic. We then go to see the customer or send the designs to him and arrange a meeting following an opportunity for him to study them. At this meeting we may be confronted with a temperamental outburst by a managing director who believes in putting on an act, or we may, if fortunate, be met half way by a reason-

This new moulding for a lemon squeezer, produced by Lorival Plastics, on behalf of Dodwell & Co. Ltd., export merchants, is an example of design by Mr. Jas. de Holden Stone. It is moulded in two parts, and does not require the addition of metal accessories. Production is in a coloured range of compression-moulded urea-formaldehyde. The draining tray has ample capacity for the pips of six lemons. The conventional glass lemon squeezer is also illustrated.

able man who can appreciate the thought we have put into the design. Sometimes we get immediate and unqualified approval; at other times, unqualified condemnation.

If all goes well, we proceed to the next stage, which is the delicate question of price. The designer himself, or one of the design staff who is thoroughly familiar with the project, now prepares detailed drawings of the product, and these are passed to the estimators. This estimating is a trick affair, because the article in question has never before been made and it is not possible to know exactly how it will behave in production. However, with the aid of factory standards and experience an estimate is produced. At the same time, it is very often a good thing to produce an accurate full-size mock-up in wood.

The price is approved, dimensioned drawings and mock-up are scrutinized and passed, and the drawings are then sent to the drawing office for the preparation of mould designs. This highly skilled work is carried out by engineer draughtsmen who specialize in mould design. Their drawings are passed to the tool shop, and in due course the new moulds are mounted in the press and samples make their appearance. The first production of moulded samples is an exciting business. If the designer and the customer are satisfied, and if the works manager admits that production will go smoothly, it is an occasion for congratulation all round.

SALES PROMOTION AIDED BY PLASTICS INTERIOR

AN immediate and consistent increase of 20 per cent. in sales turnover has been reported by the management of the Moo-Cow Milk Bar circuit following the renovation of one of their branches in London, using laminated plastics.

The advantages which laminated plastics are generally acknowledged to possess for interior decoration lie in their attractive appearance combined with mechanical strength and hygienic properties. These factors, apart from others, such as the immunity of the material from corrosion, result in a longer working life, and enable the initial cost to be offset by negligible maintenance charges. The experience of the Moo-Cow Milk Bars, however, suggests the prospect of a more rapid return on first costs where results may be affected by the attraction of casual customers.

In the reconstruction of the milk bar at Cambridge Circus, " Warerite " laminated plastics have been adopted throughout for the decorative scheme. The designer, Mr. Richard Levin, M.S.I.A., has embodied some unusual features. He found that the available space was small, and one of the problems was to afford the accommodation required without creating a suggestion of overcrowding. In endeavouring to achieve a sense of spaciousness, likewise avoiding oppression, he adopted a pink, white and dark red colour scheme, also making use of the height of the room for storage space.

A second problem arising from restricted space was to provide adequate ventilation. This has been achieved by creating a chimney-like effect to encourage the rise of hot air to the ceiling, from where it is extracted by five " Vent-Axia " fans.

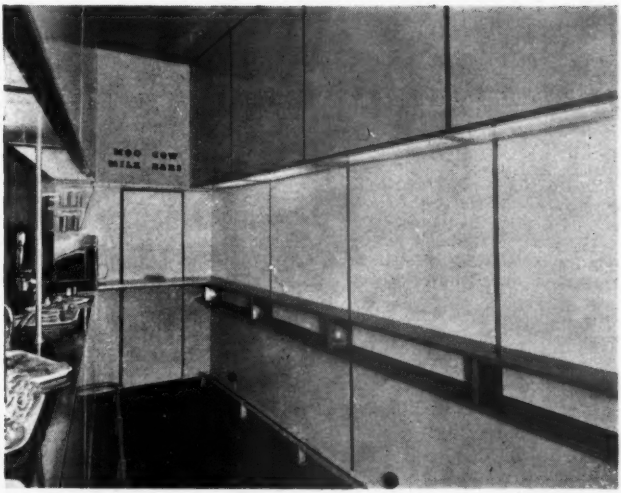
Entering the bar from the street, the main service counter is on the left. The top of this counter is faced with " Warerite " panelling of dark red colour 5/32 in. thick; while the flush front to the counter is built up with pink panels, 3 ft. 6 ins. wide. The junctions of panel and edge of the bar are masked by use of a gold-coloured anodized aluminium strip.

Three feet above the counter is a box fitting which extends to a height of 4 ft. and is carried all round the room. This serves the triple purpose of housing the lighting fittings, affording storage space, and providing a deliberately contrived funnel which encourages updraught and so assists the ventilation. This " box canopy " is built from pink " Warerite " panels screwed to a timber framework. This same method of preparing a simple timber frame to which the plastics sheets are fixed by screwing is standard throughout the job.

Sandwich containers, accessible only from the service side of the counter, are suspended from this canopy; these are made of " Perspex."

On the same level as the counter top, and virtually a continuation of it, some desirable shelving for customers' use is provided around the remainder of the free wall surfaces. On the right-hand wall there are two such shelves made from " Warerite "-veneered board, distinctly narrow but adequate, the dark red surface of which contrasts effectively with the ivory panels above them. These ivory panels extend to a height of 3 ft. before giving place to the pink box lighting enclosure.

The colour scheme throughout the renovated bar is cheerful and appropriately fresh for association with the dispensing of milk, but although their ability to provide colour is an important asset, the practical advantages of laminated plastics are of even greater importance in decorative schemes of this type. Additionally, the material is un-

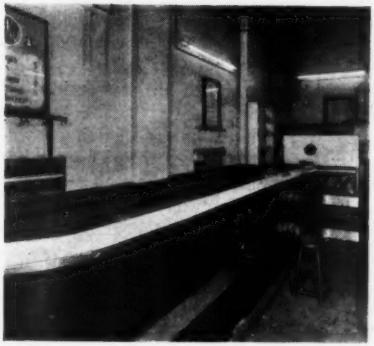


Warerite wall panels are screwed to timber framework, the junctions being masked with anodized aluminium strip.

affected by water, fruit juices, or hot liquids, and the non-porous surface may be kept clean by wiping with a damp cloth. Neither is it likely to be fractured or cracked by hard knocks. Resistance against the damage normally offered by hot dishes is also notable.

The laminated plastics were supplied by Warerite, Ltd., of Ware, Herts, a unit of Bakelite, Ltd.

(Above) View of the completed Milk Bar, laminated plastics used throughout in a colour scheme of pink, red and ivory.



(Left) Immediately before the renovations were commenced, showing war-time wear and tear.

DESIGN AND THE RETAILER

A joint conference on Industrial Design was held under the auspices of the Council of Industrial Design and the Federation of British Industries at the Victoria and Albert Museum, September 26-27, as another event to increase the usefulness generally served by the "Britain Can Make It" Exhibition. To this conference, Mr. H. A. Holmes, chairman and managing director of Selfridge's Ltd., contributed a talk upon the subject of "Design and Selling" from point of view of the retail markets. We give below some of the points stressed.

AT home, said Mr. Holmes, good design matters, because it is better to sell to an informed and interested customer than to a disinterested customer. It is obviously easier to sell a well-designed saucepan than a badly designed one. It is easier to sell furniture and furnishings to people who know a little about furniture and who are interested in design, than it is to sell to those persons who are indifferent to design.

But the point goes much deeper than that. If you want to make people really interested you have need to tell them "why." If you tell people "why," you will find that they prefer to learn about the good rather than to pick out the points of the bad. It is self-interest; partly that man likes to learn, and partly that man wants to better himself. In short, good design will create an interested market, and an interested market is one which is satisfied, curious—and comes back for more.

Regarding the question "What can the retailer do about it?" surely he can co-operate with the manufacturer to produce good designs and, in particular, to enable good designs to be produced at a reasonable price. He can also co-ordinate the activities of many manufacturers and ensure that a level of good design is maintained through a large range of goods. Finally, he can educate the public. Nevertheless, retailers have to stock what they can sell. Retailers also have to take what the manufacturer gives them. Yet the retailer, with his constant daily vast contact with the public, should be able to sense what is wanted. However, in the present sellers' market the retailer, just as often as his customer, has to take what he can get.

It is particularly desirable that retailers co-operate with manufacturers in the design of goods. Here, suggested Mr. Holmes, is a very fruitful source of development, particularly if we link the advantages of mass distribution to mass production. If we can get into the sort of situation in which the retailer suggests some lines of thought, and in which the manufacturer develops those lines of thought with his designers and the retailer; and if, in the end, a really first-class production on which a lot of thought has been spent, apart from a lot of money, we are getting somewhere. For having got the results of co-ordinated effort, it should be possible for the retailer to place the bulk order that will enable the manufacturer to see his way clear on the production and sales side.

If we can get this sort of thing going properly we shall not only be getting goods to people at the right price; we shall also be getting merchandise of greater attraction, for it should be possible to spend the time and money to analyze and experiment and also acquire first-rank creative talent.

In the utilitarian ranges, we can show quite clearly why a certain saucepan is better than another. In the decorative ranges we can imply that goods are appropriate to the times in which we live, or that they are not.

Summing-up, Mr. Holmes said that good design does matter to the retailer, and with a rising standard of living it will matter a great deal more. The retailer can foster good designs by co-operating with the manufacturer and by placing bulk orders that ensure that good designs are properly exploited and made available. The retailer can also help to raise the general level of design by co-ordinating the goods he has to sell.

(Above)
Animal and mythological subjects are the theme of designs by Miss Phyllis Bray, which have been incorporated in Warerite laminated plastics during manufacture and subsequently used for these attractive table - tops, which find use in tea rooms and like situations.

(Right)
Warerite laminated plastics also offer advantages for the nursery, because they are colourful, hygienic and tough wearing. The designs decorating the alcove for the bed in this nursery are highly original, and have been incorporated in the Warerite during manufacture. They continue over the "ceiling" of the alcove as well as each side, which is pleasing for the roving eyes of the child.

PLASTICS IN GERMANY

The New Target in Germany is the Science behind the Industries. The following are additional Notes from the Official Reports which can be obtained from H.M. Stationery Office

BIOS Final Report No. 171.—This report deals with the catalytic hydrogenation of acetylene to ethylene as carried out at Gendorf. The process is a convenient alternative source of ethylene when other sources are not available, but cannot compete when ethylene is obtainable from petroleum refinery operations or when alcohol is produced from cheap molasses. This plant has been the subject of a previous investigation, CIOS Report No. XXV-17.

BIOS Final Report No. 445.—This is Part 3 of the Investigation of German Plastic Plants, and relates to the processing of polyvinyl chloride. It covers the production of calendered sheet from p.v.c., the printing of calendered soft Mipolam sheet, calenders for p.v.c., the production of cable masses, double-screw extrusion machines, the moulding of p.v.c., and the production of gramophone records. In all, there are 114 pages, including numerous appendices upon such aspects of processing as manufacture of soft Mipolam sheet for rain capes and soft Mipolam calendered on cloth for protective clothing and upholstery.

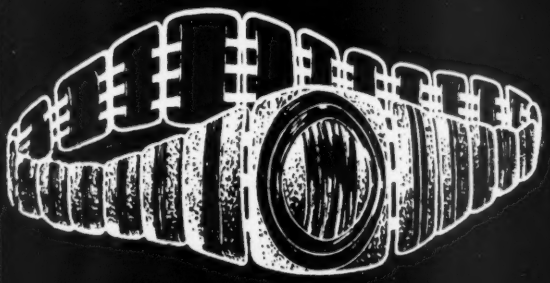
BIOS Final Report No. 507.—In this report there is a short general description of the synthetic phenol plant at the works of Dr. F. Raschig G.m.b.H., Ludwigshafen. Some useful flow sheets are included, as well as a calculation of production costs. The remainder of the report deals with coal-tar distillation, chlorinated phenols and phenol-formaldehyde resins. Raschig was one of the pioneers in the field of phenol-formaldehyde resins, and plant and processes show several unusual features. Among the products, the coloured Resol based moulding powders are of particular interest and deserve further consideration as replacements for urea-formaldehyde resins. In normal practice the Resol resins are made by an alkaline condensation, with a reaction mixture having a phenol-formaldehyde mole ratio of 1:1.5, sodium hydroxide being used as catalyst.

BIOS Final Report No. 744.—The manufacture of vinyl acetate polymers and derivatives at I.G. Hoechst is the subject of this report. It appears that no real information was obtained, although a number of the research men who had taken part in polymer research were interrogated. In the words of the report: "They talked vaguely of the work which they intended to do, but nothing of value came out of the discussions." It was on the mechanism of the aldehyde reaction that there was the "greatest measure of excited disagreement" among the research workers. A more or less complete piece of work had been done on the inhibiting effect of oxygen on the polymerization of chloroprene, but few details of this work were remembered, and it was noted that all copies of reports had been destroyed.

BIOS Final Report No. 745.—This report gives a description of plant and process for manufacture of vinyl acetate using acetylene (derived from calcium carbide at works) and acetic acid (99 per cent. pure) as raw materials. Great stress is laid on the necessity for removing acetaldehyde as completely as possible, as it has a pronounced effect on the polymerization of the monomer. When making polymer of 300,000 mol. wt., some acetaldehyde is essential, but it is considered preferable to purify the monomer rigorously and then to add back controlled amounts of aldehyde. When free of aldehyde, the monomer can be stored under nitrogen without any inhibitor for a period of months without evidence of polymerization, but it is necessary to re-distil before use in order to have control of polymerization.

PERSONAL PLASTICS

Items for Milady



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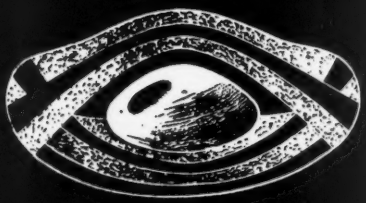

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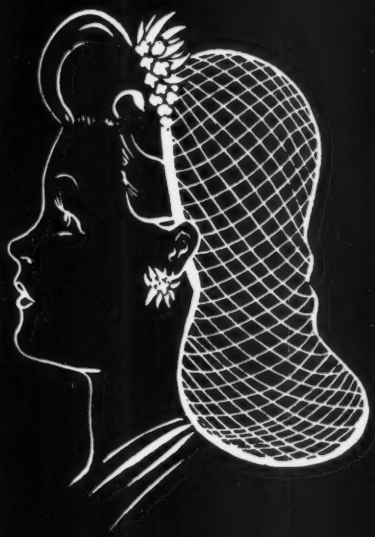

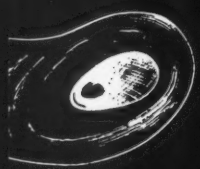

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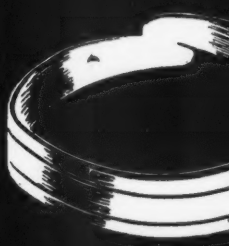

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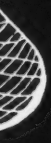
ONS FROM THE PLASTIC RESEARCH LABORATORIES OF GEORGE B. E

WIDE BELTS

THESE BELTS ARE EXTRUDED SECTIONS FROM SEMI-RIGID MATERIALS, SUCH AS CELLULOSE ACETATE THREADED WITH P.V.C. EXTRUDED STRIPS AND MOULDED BUCKLE ON WHICH A PHOTO OF A FILM STAR CAN BE LAMINATED.



EXTRUDED
CARRIES THE
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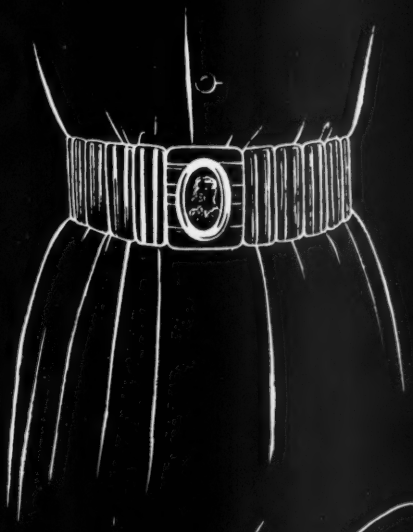
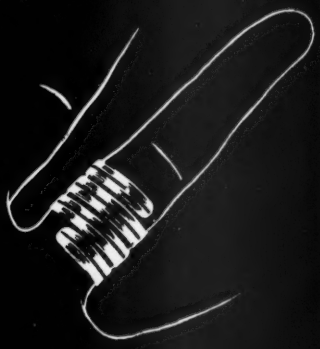




LET AND RING

RIGID EXTRUDED STRIPS.

ORGE B. E. SCHUELER, CONSULTANT.

World's Industry Employs Plastics

GENERAL ENGINEERING

Stress concentrations can be eliminated in many cases by matching the coefficients of thermal expansion of the component parts, as appears from an analysis of the causes of internal stress concentrations in rigid adhesive layers. P. S. Turner has investigated the effects of various factors on bond strength and has developed a formula for calculating coefficients of thermal expansions of mixtures and their applications. A second part of this study (Journ. Research Nat. Bur. Standards, 1946/**37**/239, Rp. 1,746) deals with the determination of coefficients of thermal expansion of plastics. **Rubber - metal composites** are the subject of an interesting study by J. A. Merrill, with special consideration of the modern synthetic rubbers, including Buna N, butyl rubber, silicone rubber, vinyl chloride, vinylidene chloride, vinyl copolymers, GR-S, polythylene, and thiokol liquid polymers. Some typical examples, such as rubber de-icers for propellers, are dealt with. (" Materials and Methods," 1946/Oct./891.) **" Sandwich " materials,** such as Du Pont CCA, a cellulose acetate in an unorientated multi-cellular form between plywood, metal or glass cloth faces, are described by R. E. Maier (" Aviation," 1946/July/72). **Sealing porous castings** by plastics, as developed by Commercial Structures, Ltd., involves forcing solution into the casting under a pressure of 6,000 lb. per sq. in. While the actual impregnation is carried out at normal temperatures, the temperature is subsequently increased to about 100 degrees C. to evaporate the solvents. After this, the temperature is further increased. In severe cases a second complete treatment may be applied. (" Mechanics," 1946/Nov. 22/72.) **Hobbing of plastic moulds** is described in " Machine Shop Magazine " (1946/Sep./54); the author deals with the hobbing process, the master hob, mould materials, and design of the mould. **Plastic laminates** are discussed in " Materials and Methods " (1946/**24**/654). This article deals with general selection factors, high- and low-pressure laminates, composite and " sandwich " materials, and the machining of the product. **Structural plastics,** which need no timber support, are hampered by building costs, according to Lincoln Industries Inc. (" Scientific American," 1946/Nov./216.)

CHEMICAL

Synthesis of organosilicons and their conversion to polymeric silicones is the subject of many recent articles. A brief discussion of composition and structure of silicone polymers, from the standpoint of the user, has been given by E. G. Rochow with the idea that a working knowledge may aid intelligent use. (Electrochemical Society Preprint 90-18, Oct., 1946.) **Polymers of tetrafluorethylene** (trade name, Teflon) are unique among organic compounds in their resistance to heat and chemicals, and in their very low dielectric loss over a wide range of frequencies. E. B. Yelton deals with those properties of this unique material which are of interest to the electric industries. (Electrochemical

Society Preprint 90-15, Oct., 1946.) **Silicone greases,** some entirely of inorganic material, others compounded with metallic soaps, are giving outstanding results. A weight loss of only 3.3 to 5.2 per cent. occurred after 40 hrs. use at 347 degrees F. ("Power Plant Engineering," 1946/**50**/No. 7/86.)

ELECTRICAL

Creeping path strength, as a feature of the testing of electrical insulation materials, is reported upon by the Swiss Association for Material Testing. The draft for a Swiss standard contains definitions only, it being stated that it is not yet possible to suggest a uniform testing method. Various testing methods developed in Switzerland are described and published for criticism. These include the knife-edge method of the Swiss Electrotechnical Society, Zurich; the test apparatus of Micafil A.G., for determining the creeping path formation by means of water vapour; and those of comprehensive researches carried out by the department for industrial research at the Institute for Technical Physics, Zurich, under Dr. Staeger, who is chairman of the sub-committee responsible for this standardization programme. (Schweizer Archiv f. angew. Wissenschaft and Techn., 1946/Oct./323.) **Draft Standards** on creeping path strength and safety against creeping paths (S.V.M.T. 23, 3rd draft, Oct. 15, 1946) propose the following definitions: Creeping paths can be formed on the surface of insulating materials between positions of different electric pressure (direct or alternative current). Local increase of current density leads at first to unconnected creeping traces, which later combine to a connected creeping path. Formation of creeping traces and creeping paths is exclusively a surface phenomenon. It is influenced by the following factors: Shape of surface, properties of the insulating material, surface quality (degree of machining), the action of external influences. The latter can be considered as follows: (1) Temperature actions, i.e., thermal destruction at the surface (excessive heat, sparks, electric arcs, etc.). (2) Impurities. These can be subdivided into (a) those without primary corrosive action, and (b) those with primary corrosive action. Actions under (a) may be caused by conducting materials accumulated at the surface during service conditions, such as metal dust, graphite dust, moisture, moist fibres, hygroscopical salts; actions under (b) attack of foreign materials, such as water, electrolytes on surface, etc. Based on these data, creeping path strength is defined as resistance of an electrical insulating material against the formation of a creeping path. The safety against the formation of a creeping path is the quality of an electrically insulating arrangement, and therefore incorporates both the creeping path strength as well as design of the component. In the case of laminated and lacquered materials, destruction may occur on the internal boundaries, but these cannot be defined as actual creeping paths.

MISCELLANEOUS

Bonded abrasive honing sticks are incorporating transfer moulded rectangular plastic wedges of phenolic thermosetting resins. Micromatic Hone Corporation have adopted these wedges in connection with a master sizing ring that controls final cylinder-bore size to uniform accuracy. ("Production Engineering," 1946/Sep./100.) **100-ton Press** of semi-automatic operation for either compression or transfer

moulding of plastics has been developed by Watson-Stillman Co., of Rosalla, N.Y. (" Materials and Methods," 1946/Oct./1014.) **Design in plastics,** ceramics and metals is discussed by A. J. Schroeder from the point of production technique and suitability (" Aircraft Engineering," 1946/Oct./357). **Hingeing acrylic boxes** without marring their appearance with metal hinges or screws can be accomplished by a new method called " hinged Plexiglas," which involves laminating vinylite to Plexiglas; neither material is affected in physical or chemical properties by the process, which has been developed by the Willson Plastics Division and is being utilized by Amplex Plastics Corporation. (" Scientific American," 1946/Nov./216.) **New method of processing** a plastic material to afford a protective means for a host of industrial products has been announced by General Electric Plastics Div., Pittsfield. (Machine Tool Blue Book, 1946/Sep./225.) **Furnishing materials** with a plastics basis are discussed in " Scientific American," 1946/Nov./214. Vinyl resins are used as substitutes for rubber coatings, and proved to be clean and colourful. **Protective coating,** Plastipak, claimed to be proof against moisture, acid and alkali, can be applied at room temperature either by dipping or spraying, according to Puritan Co. Inc. (Machine Tool Blue Book, 1946/Sep./286.) **Fire risks from plastics** are treated in " Scientific American," 1946/Nov./201); plastics are shown to be less inflammable than wood. **Plastic sheeting** of tough, pliable and washable nature, for use in making handbags, purses, belts, briefcases, etc., is being produced by the United States Rubber Co. Known as U.S. Royalene, the sheeting is made without fabric backing or surface finishing coat. (" Chem. and Met. Eng.," 1946/July/160.) **Nylon filament** to the length of 29 million ft. is contained in 100 ft. of ½-in.-diameter yacht rope. Nylon yacht rope has higher tensile strength, greater elasticity, more resistance to rot and better ease of handling than alternative materials. (" Scientific American," 1946/Nov./228.) **Synthetic rubbers,** such as GR-S and nitrile, are compared with natural rubbers, as regards compounding, processing, vulcanization, and physical and dielectric properties, in a thorough investigation by G. G. Winspear, D. B. Herrman, F. S. Malm and A. R. Kemp. Their paper deals in particular with synthetic-rubber compounds suitable for commercial ebonite fabrication. (" Ind. Eng. Chem.," 1946/July/687.) **Buna S rubber,** with some of the problems arising out of efforts to achieve the best possible material for the war emergency, is reviewed by G. S. Fuller. This investigation, which contains several photographs of interesting laboratory equipment, was carried out under the sponsorship of the Reconstruction Finance Corporation, Office of Rubber Reserve, in connection with the Government synthetic-rubber programme (Bell System Tech. Journ., 1946/**25**/351). Part of the research was transferred to the Bell laboratories because of their past contributions in the field of high polymers; the paper deals particularly with work relating to the characterization and control of the final copolymer.

SOURCES OF REFERENCE.

We wish to remind readers that the sources of reference from which these pages are compiled are not, in general, retained in this office. We cannot, therefore, undertake to supply such originals. Nevertheless, most of the foreign journals referred to are available in the Patent Office Library (Southampton Buildings, Chancery Lane, W.C.2) and in the Science Library (South Kensington). Photo-duplicated copies of articles may be obtained from the Photostat Dept. of the Patent Office.

Scratch-resistant Coatings
for Methyl Methacrylate

By E. E. HALLS

FOR certain applications, a serious shortcoming of the methyl methacrylate plastics is the ease with which the surface becomes scratched. This is obviously a disadvantage in all applications where this plastic is employed in any sense as a window material, the degree of seriousness being more or less according to the purpose for which the material serves.

When methyl methacrylate resins are used for optical purposes, the possibility of loss of surface quality has to be avoided at all costs. In some instances, this may be practicable by virtue of the method of mounting the component in apparatus, giving direct or indirect protection against mechanical damage. However, in numerous cases it is desirable to apply a surface protection to the methyl methacrylate component itself. This is done in the case of optical lenses. Obviously the subject of this coating is not only an important one, but it is very intricate in so far as the right composition has to be evolved to give the desired mechanical protection without in any way detracting from the properties of transparency normally exhibited by this material.

The provision of a coating medium for this purpose has been successfully achieved in practice, and the "glass coating" of methyl methacrylate plastic lenses is a recognized procedure. In relation to this subject in general, considerable interest has been aroused by U.S. Patent 2,404,357/1946, of E.I. du Pont de Nemours and Co.

The interest given to this is threefold: First, because silicon ester is the basis of the coating media covered by this patent, the silicon plastic being a very logical line of investigation for the particular purpose. Secondly, by the fact that the patented procedures seem to be very promising for successful commercial application. Finally, it results from the wider possibilities of this coating material on methyl methacrylate polymers, and on other plastic materials. Among these are included protection against moisture and weathering, and even against the results of electrical leakage, such as the prevention of carbon cracking under conditions of momentary flash-over.

The patent has the title "Coated Methyl Methacrylate Polymer," and relates more particularly to improving the scratch resistance of methyl methacrylate polymer sheet material and the like. It refers to methods previously proposed for this purpose, viz.:—

(1) The application to the surfaces concerned of polymerizable substances having two or more olefinic groups per molecule.

(2) Condensation upon the surfaces of hard substances by a process of volatilization.

(3) The application to the surfaces of solutions of methyl silicates, followed by precipitation of a hydrated silica $SiO_2.xH_2O$, finally leaching out the soluble portion of the compound.

The first of these methods has limitations imposed by the inherent softness of the organic coating materials used. The other methods are both intricate to control; they yield films that are porous and which are liable to be too weak to provide satisfactory scratch-resistance.

The object of the patent is to provide an economic and practicable process for yielding coatings on methyl methacrylate polymer sheets, the films having high scratch resistance, and retention of this property as well as clarity and smoothness upon exposure to the weather.

Briefly, the patented process constitutes the application to the polymethyl methacrylate body of a solution comprising ethyl silicate hydrolyzed with an amount of water equal to at least 15 per cent. by weight of the ethyl silicate, and a vinyl acetate polymer in the proportion 1 part (by weight) to 1-99 parts of silica content of the solution. The coated surface is dried and then pressed against a rigid surface at an elevated temperature and pressure in order to cure the coating thus formed, and to bond it to the surface of the base material.

Specifically, the process can be carried out by preparing the solution of the above specified components, making this either by forming the hydrolyzed ethyl silicate solution first, allowing it to age, and then mixing it with a solution of the vinyl acetate polymer, or by mixing all of the ingredients together without prior hydrolysis of the ethyl silicate and then allowing this solution to age. The solution is then applied to polymethyl methacrylate plastic, preferably by immersion and withdrawal. Curing and bonding of the coating to the base material is achieved by pressing the coated surface with appreciable pressure against a rigid surface such as a smooth glass or metal sheet, maintaining at an elevated temperature.

Examples of Application

Commercially available technical grades of ethyl silicate (chiefly tetra ethyl ortho silicate) and good commercial grades of vinyl acetate polymers are suitable for the process. Examples are given as below, all parts being by weight unless indicated otherwise; abbreviations, "p.v.a." for poly vinyl acetate, "e.s." for ethyl silicate, and "p.m.m.a." for poly methyl methacrylate are employed.

EXAMPLE 1.—The use of non-hydrolyzed p.v.a. and hydrolyzed e.s. in a hot pressed coating.

One hundred parts of e.s. is hydrolyzed by stirring in 48 parts of ethyl alcohol and 44 parts of 0.1N hydrochloric acid. Temperature rises spontaneously to about 60 degrees C. in about 5 mins. Stirring is discontinued, and the solution allowed to age till required for use. The coating solution is then made up from the following quantities:—

	Parts
10% Solution of p.v.a. (medium viscosity) in denatured alcohol	90
Glacial acetic acid	300
Ethyl alcohol	110
Hydrolysed e.s. solution at the age of 5 days	300

The sheet of p.m.m.a. is dipped in this coating solution for 2 mins., drained, and dried in air at 35 per cent. humidity for 8 mins. It is then placed between sheets of polished chromium-plated steel, which just cover all areas of the coated sheet to be cured. The assemblage is placed in a mould of the same shape as the sheet in order to prevent large dimensional changes during curing.

Curing is achieved at 155 degrees C. between the platens of a hydraulic press. The platens are closed rapidly in order to apply the pressure (1,110 lb./sq. in.) immediately. Due to heat lost to the cold mould, the temperature falls to about 140 degrees C. in a few minutes, but returns to 150 degrees C. within 5 mins. by virtue of heat input, which is regulated by a control unit. The heat is then switched off, and the assembly cooled to 80 degrees C. in 25 mins. The pressure is next released, and the assembly opened. A clear silica/vinyl resin coated p.m.m.a. sheet is obtained. It is very resistant to scratching when scoured with wet carborundum powder, and withstands water immersion for 76 days before evidence of surface cracks.

EXAMPLE 2.—The use of hot pressed silica/hydrolyzed p.v.a. in which the vinyl acetate is modified with a relatively large amount of ethylene by interpolymerization.

The coating solution is prepared by mixing the following ingredients in the order given:—

	Parts
4.5% Solution (by wt.) of hydrolysed ethylene/vinyl acetate polymer (mole ratio 1/1.1) prepared by refluxing the polymer in ethanol/water (80/20 by wt.)	160
Glacial acetic acid	240
Hydrolysed e.s. solution aged for 1 day	240

The panel of p.m.m.a. is coated by dipping for 2 mins., drained, and air-dried for 15 mins. at 36 per cent. relative humidity. It is assembled between the polished sheets and placed in a mould as before. Initial temperature of the press platens is 200 degrees C., and after 5 mins. 190 degrees C. They are cooled to 90 degrees C. within 2 mins. The pressure (1,110 lb./sq. in.) is then released and the coated plastic sheet removed. The silica/vinyl resin coated surface is unaffected by water immersion at 75 degrees C. for 1 hour, and is unusually resistant to scratching with wet carborundum powder.

EXAMPLE 3.—The use of a highly hydrolysed, completely water-soluble p.v.a. in a hot-pressed silica-containing coating, which cures to a completely water-insoluble film.

The solution is prepared from the following weights of ingredients in the order named:—

	Parts
4.5% Solution of 90% hydrolysed low viscosity p.v.a. in water ...	100
Hydrolysed ethyl silicate solution aged for 4.5 hours	150
Glacial acetic acid	150

The p.m.m.a. sheet is dipped in this solution for 2 mins., drained, and dried in air at 34 per cent. relative humidity for 11 mins. The curing is achieved as in Example 2. The resultant sheet, coated with silica/polyvinyl alcohol resin, shows unusually high resistance to scratching with wet carborundum powder, and the surface is unaffected by water immersion at 75 degrees C. for 1 hour.

EXAMPLE 4.—The use of a p.v.a. hydrolysed to an intermediate degree in a hot-pressed silica-containing coating.

The solution is prepared from ingredients in the following order:—

	Parts
5% Solution (by wt.) of 52% hydrolysed high viscosity p.v.a. in ethanol-water (70/30 by wt.)	150
Hydrolysed ethyl silicate solution aged for 44 hours	150
Ethyl alcohol	75
Glacial acetic acid	225

The treatment of the p.m.m.a. sheet is by dipping for 2 mins., draining, air drying for 15 mins. at 19 per cent. humidity, and then curing as in Example 1, except that the press platens are initially at 175 degrees C. and maintained at this temperature for 10 mins. before cooling to 25 degrees C. within 5 mins. The resultant coating is glossy and transparent, substantially non-scratched by scouring with wet diatomaceous earth, and will withstand exposure to air at 60 degrees C. without deterioration for at least 50 days. Further, upon outdoor exposure during winter and summer months, no loss of optical perfection occurs from weathering or scratching, even though airborne dust is rubbed off with a dry cloth.

EXAMPLE 5.—The use of a relatively large quantity of partially hydrolysed p.v.a. in a silica-containing hot pressed coating, as well as the hydrolysis of e.s. without the initial presence of a common solvent for the ester and water.

Ethyl silicate (100 parts) is hydrolysed by agitation with 44 parts of 0.1N. hydrochloric acid. The reaction mixture evolves heat and then cools to room temperature within 1 to 2 hours. The actual coating mixture is prepared from ingredients in the following order:—

	Parts
52% Hydrolysed p.v.a. solution of Example 4	210
Hydrolysed e.s. solution just described and aged for 21.75 hours	97.5
Ethyl alcohol	77.5
Glacial acetic acid	225

The sheet of p.m.m.a. is coated by dipping for 2 mins., draining, and air drying for 15 mins. at 17 per cent. relative humidity. It is cured as in Example 4. The resultant protective film is unblemished, possesses excellent resistance to scratching when scoured with diatomaceous earth, and resists exposure in air at 60 degrees C. for at least 35 days without crazing.

EXAMPLE 6.—The use of a silica/partially hydrolysed p.v.a. coating cured at high temperature.

The coating solution is prepared from ingredients in the following order:—

	Parts
52% Hydrolysed p.v.a. solution of Example 4	120
Hydrolysed e.s. solution of Example 1 aged for 72 hours ...	160
Ethyl alcohol	95
Glacial acetic acid	225

The sheet of p.m.m.a. is coated in this coating solution by dipping for 7.5 mins., drained, and dried for 20 mins. in air at 29 per cent. relative humidity. Curing is as in Example 1, except that the initial platen temperature is 220 degrees C. and the temperature is maintained between 209 degrees C. and 223 degrees C. for 10 mins. The assembly is cooled to 25 degrees C. within 5 mins. The resultant product has a glass-like finish, which is substantially non-scratched when scoured vigorously with steel wool. It resists hot water at 60 degrees C. for 360 hours without crazing. It withstands the Kline accelerated weathering test (exposure to a sun lamp for 20 hours and exposure to water mist for two 2-hour periods per day) for 500 hours without deterioration. It withstands outdoor exposure during winter and summer months without evident change.

EXAMPLE 7.—The use of a coating solution without prior hydrolysis of the ethyl silicate.

The solution for coating is prepared by mixing ingredients in the following order:—

	Parts
52% Hydrolysed p.v.a. solution of Example 4	200
0.1 N hydrochloric acid	61
Ethyl alcohol	225
Glacial acetic acid	375
Ethyl silicate	139

The sheet of p.m.m.a. is dipped in this solution after ageing for 16.8 to 67.2 hours for 7.5 mins. It is drained and air-dried for 20 mins. at 31 to 35 per cent. relative humidity. Hot pressing is as in Example 1, except the platens start at room temperature and are raised to 175 degrees C. in 15/20 mins. and maintained at an average of 175 degrees C. for 10 mins. They are cooled to room temperature in 5 mins.

The coated sheet is clear, very resistant to scratching by scouring with abrasive powders, and water-resistant at 60 degrees C. for 144 hours before crazing. It withstands 500 hours exposure to the carbon arc Fade-Ometer without visual deterioration.

EXAMPLE 8.—A convenient method for preparing a large quantity of coating solution containing hydrolysed e.s. and partially hydrolysed p.v.a., and a process of coating and curing large panels using an oil-filled auto-clave.

A hydrolysed e.s. solution is made by mixing 640 parts of e.s., 320 parts of denatured alcohol, 1.5 parts concentrated hydrochloric acid, and 269 parts of distilled water. A solution of 52 per cent. hydrolysed p.v.a. is made by soaking 105.3 parts of the polymer in 1,400 parts of denatured alcohol for two days, then adding 600 parts of water and agitating until solution is complete. The actual coating solution is produced from ingredients mixed in the following order:—

	Parts
Hydrolysed e.s. solution aged 1 hour	1,200
Partially hydrolysed p.v.a. solution	900
Glacial acetic acid	640
Denatured alcohol	80

A sheet of heat-treated p.m.m.a. plasticized with 10 per cent. dibutylphthalate is cleaned with a lint-free cloth moistened with methyl alcohol. The sheet is immersed in the solution after it has aged for 64 to 90 hours, the immersion period being 15 mins. The sheet is mechanically withdrawn at a rate of 8 ins. per minute into an atmosphere of 20 per cent. relative humidity and 27 degrees C. It is allowed to drain and dry for 20 mins. The sheet is then mounted between dry glass plates of the same dimensions as the sheet itself. The assembly is wrapped in paper, and placed in a flexible bag which is capable of being evacuated and of withstanding hot oil under pressure. The bag is evacuated to about 25 ins. of

mercury, sealed off, placed in an autoclave which can be heated and cooled by circulating oil. It is subjected to the following cycle:—

Operation.	Time. mins.	Initial temp. °F.	Final temp. °F.	Pressure lb./sq. in.
Heating ...	5	100	300	200
Run ...	30	300	300	200
Cooling ...	15	300	125	200

The assembly is removed and allowed to cool further in room atmosphere. After about a minute the sandwich disassembles spontaneously due to differential contraction.

The silica/partially hydrolysed p.v.a. coating obtained in this way is transparent with glass-like smoothness. It is not scratched when cleaned with powders such as pumice and diatomaceous earth, and it strongly resists scratching when scoured with steelwool. It is visually unaffected by soaking the panel in water at 60 degrees C. for 300 hours.

EXAMPLE 9.—A preparation of a coating solution containing ethyl silicate prehydrolysed with 20 per cent. of its weight of water and containing 70 parts of silica for 30 parts of partially hydrolysed p.v.a.

Three hundred parts of e.s. is hydrolysed by mixing with 228 parts of alcohol of water content 5.27 per cent. by weight, and slowly adding with agitation 48 parts of 0.1N hydrochloric acid. A solution of 52 per cent. hydrolysed p.v.a. is made by dissolving 210.6 parts of dry polymer in 2,800 parts of denatured alcohol and 1,200 parts of water. The actual coating solution is mixed as follows:—

	Parts
Partially hydrolysed p.v.a. solution	360
Hydrolysed e.s. solution, aged 96 hours	280
Denatured alcohol	80
Glacial acetic acid	200

A sheet of non-plasticized p.m.m.a. is coated by immersion for 5 mins., withdrawn vertically at a rate of 8 ins. per min. into an atmosphere of 25 per cent. humidity at 78 degrees F. It is dried thus 30 mins. and then assembled and cured as in Example 8, except the maximum temperature of 300 degrees F. is maintained for 20 mins. Large sheets coated in this manner are unusually free from optical defects and have high quality of scratch resistance and exposure resistance.

The process of the invention is applicable to surfaces of unmodified or modified p.m.m.a. Other alkyl silicates may be employed, but ethyl silicate is preferred.

The amount of water used in the hydrolysis of the ethyl silicate is important. It must be such that, as the ester hydrolyses and condenses into a polymer in the presence of suitable solvents, a single phase is maintained throughout the process. This is particularly emphasized during the drying and hot pressing portions of the cycle, when water and solvent are being expelled from the solution and reaction of the condensing (dehydrating) silicic acid structure with partially hydrolysed vinyl acetate, or ester interchange with the non-hydrolysed vinyl acetate polymer, is possible.

It is stated that the minimum amount of water for the hydrolysis is 15 per cent. by weight of the ethyl silicate. To obtain a coating of satisfactory scratch resistance, 17.5 per cent. minimum is desirable, unless particular attention is given to favourable catalyst concentration, and the hydrolysis is effected at elevated temperature and prolonged ageing of the ethyl silicate solution allowed before use. The preferred minimum is 20 per cent. of water, because scratch resistance of the film increases with the water constituent up to 20 per cent., from 20 to 100 per cent. little further improvement is achieved, and with more than 100 to 150 per cent. the hydrolysed product becomes difficultly compatible with some vinyl acetate polymers.

Relative to the last point, some vinyl acetate polymers, when completely hydrolysed (i.e. poly vinyl alcohol), are compatible with ethyl silicate hydrolysed with over 200 per cent. of water. Generally speaking, 20 to 75 per cent. of water is given as the most satisfactory range.

The presence of a solvent for the ethyl silicate such as ethyl, methyl, or propyl alcohol or acetone or the like, is not essential initially in the hydrolysis. It is, however, preferable because the resultant

solution hydrolyses more slowly. The use of a proportion of alcohol up to 100 per cent. by weight of the ethyl silicate, or even higher, is therefore advantageous.

When an efficient common solvent for water, tetra-ethyl ortho-silicate and the hydrolysis product is not present, a relatively high concentration of catalyst is desirable for the hydrolysis of ethyl silicate. It accelerates dissolution and prevents the precipitation of silicic acid ($SiO_2.xH_2O$) due to high degree of local hydrolysis and polymerization. Consequently, it is convenient to use 0.1N hydrochloric acid as the source of water and catalyst. With efficient agitation, 0.01N hydrochloric acid is satisfactory. With an efficient common solvent such as ethyl alcohol, the reaction goes satisfactorily without catalyst.

Mineral acids such as hydrochloric, phosphoric and sulphuric, and non-volatile organic acids such as oxalic and maleic, and even more volatile and weaker ones such as acetic and formic, are suitable catalysts.

Ageing Period

The age of the hydrolysed ethyl silicate solution is important in relation to the final film with respect to scratch resistance, freedom from craze, and optical perfection after weathering. This factor is said to appear to be related to the rate of hydrolysis of the ethyl silicate and to the rate of polymerization or condensation of the product. These factors in turn are related to the quantity of water, the amount and kind of solvent and of catalyst, degree of agitation, etc.

Regarding the ageing period, the patent states that there is an initial period in which it is difficult to obtain satisfactory coatings. This is followed by a relatively long period, during which satisfactory coatings are practicable with reasonably small amounts of partially hydrolysed polyvinyl acetate present as a coating constituent. There is a final period, during which difficulty is experienced in obtaining coatings free from craze. Gelation of the solution follows this stage. Apart from crazing during the initial and final periods of ageing, difficulty with adhesion is also experienced, especially if drying occurs in high humidities. The " useful age " of these solutions varies from a few hours to several weeks.

The vinyl acetate polymer is an essential ingredient. Unmodified polymer in a state of hydrolysis from substantially zero to complete can be used. Wide variation in its viscosity is permissible. If large amounts of polyvinyl acetate hydrolysed to 75/100 per cent. are used in the coating compositions, special steps may be necessary to ensure good adhesion of the coating to the p.m.m.a. surface. Drying the coating in a controlled atmosphere, predipping in a suitable softener such as glacial acetic acid, with brief drying before immersion in the coating solution, give assistance in this direction.

Non-hydrolysed polyvinyl acetate promotes coatings of excellent adhesion, but having slightly inferior scratch and weather resistance. This is presumably due to cross-linking with the silicic acid, not being so complete and irreversible as it is with the partially hydrolysed polyvinyl acetates. A degree of hydrolysis from 20 per cent. to 75 per cent. is practicable, but 45 to 55 per cent. is preferred for the optimum combination of scratch resistance, adhesion and weather resistance. (These percentages refer to the percentage of acetyl groups removed.)

Chemically modified polymers can be used with the production of films retaining excellent properties. Thus, ethylene/vinyl acetate interpolymers with a mole ratio of 1/20 can be used directly without hydrolysis. The ethylene/vinyl acetate interpolymers with a mole ratio from 1/1 to 1/3.3 may be used in the completely unhydrolysed condition.

In general, it is stated that stable interpolymers containing an appreciable proportion of vinyl acetate can be substituted for the unmodified vinyl acetate, provided that a satisfactory solvent vehicle can be found that will bring the resin and the hydrolysed ethyl silicate into a suitable solution that can be dried and hot pressed with complete compatibility of the silica and resin.

The ratio p.v.a. to hydrolysed e.s. is dependent upon the relative importance of the properties of scratch resistance, weather resistance, unblemished appearance and flexibility in the final film. Useful coatings are yielded from the range of 1 part of p.v.a. to from 1 to 99 parts of hydrolysed e.s. (calculated on the SiO_2). Generally 1 part p.v.a. to 1.5 to 9 parts e.s. will be used. Preferred values for the different properties are given as under:—

	Parts p.v.a.	Parts e.s.
High scratch resistance ...	1	6 to 99
High scratch resistance with durability to exposure, freedom from crazing and interference colours ...	1	2 to 6
Increased flexibility with some sacrifice of scratch resistance	1	1.5 to 2
Good scratch resistance and flexibility but poorer adhesion	1	1 to 1.5

Inclusion of a solvent for p.m.m.a. in the coating mixture gives improved adhesion. The particular acid, and its quantity, must not interfere with the maintenance of single-phase solution and depositions of a continuous film.

Criteria of Coating Solution

Acetic and formic acids accelerate gelation of the coating solution, especially if present in high concentration. However, acetic acid has the advantage that it enables the coating to be dried in air of relatively high moisture content without loss of adhesion. For optimum adhesion, from 10 to 40 per cent. of acetic acid by weight in the coating solution is preferred. More than 40 per cent. can be used effectively if rapid softening of the surface is required and short dipping can be employed. When long dipping is more convenient, and carefully controlled drying can be assured, less than 10 per cent. of acetic acid is possible. Retention of excess solvent in the p.m.m.a. will lower scratch resistance and interferes with the curing of the coating.

Increased total solids in the coating solution reduces the useful age of it and yields a thicker coating. For some methods of application, up to 10 per cent. solids are required for optimum results. For very thin coatings, 3 to 5 per cent. can be used, and such are very stable solutions. Optimum coating thicknesses from 0.9 to 2.25 microns (measured on the cured film) are obtained from relatively stable solutions of 5 to 8 per cent. solids.

The essentials of the coating solution can be briefly summarized as under:—

(a) e.s. hydrolysed with at least 15 per cent. of water.

(b) p.v.a. resin.

(c) Solvent to maintain single-phase compatibility to the end of the cured film-forming process.

(d) Solvent for the base material.

No difficulty is encountered in finding (c), e.g., water, ethyl alcohol mixtures.

The coating solution can be applied by brush, spray, squeegee or dipping. In dipping, thickness can be controlled over a wide range; rapid withdrawal for thick, and slow withdrawal for thin coatings. The thickness of coating can be chosen according to the properties required:—

Thickness (microns)	Properties.
Below 0.5 ...	No scratch resistance, but useful for lowering reflectance of light, rendering surfaces anti-static.
5 to 10 ...	Craze readily upon weathering.
0.8 to 5 ...	Excellent weather and scratch resistance.

During draining and drying, excessive humidity promotes loss of adhesion; in general, it should be less than 45 per cent. The allowable value, however, depends upon the particular partially hydrolysed p.v.a. and solvents used, upon other vapours in the air, its temperature and circulation rate.

Elevated temperatures are used for curing and bonding the coating, so that desirable hardness, scratch resistance infusibility, insolubility and antistatic

properties of vitreous silica can be more closely approached than is possible at low temperatures. The pressing against a rigid surface during curing is necessary when above a temperature value dependent upon the base material and the coating composition; otherwise crazing occurs due to shrinkage stresses. A pressure of at least 100-150 lb./sq. in. is preferred whilst the coated surface is above 60 to 100 degrees C.

The hot pressing stage can be carried out in mechanical pressure or fluid-filled autoclaves; heat transfer is achieved by conduction, convection, radiation and dielectric loss or induction infra-red heating may be employed. The sheet must be between suitable mould surfaces, e.g., glass, metal, or higher melting plastic. For autoclave heating, edges must be sealed with appropriate resin or tape, or inserted in a bag (e.g., rubber or neoprene).

The coated plastic is raised to curing temperature as rapidly as convenient, and maintained there from 5 to 60 minutes. Scratch and hot-water resistance improve with increasing curing temperature, and the time necessary to give maximum properties decreases with increasing curing tempertaure. At 150 degrees C., 10-15 minutes; at 190 degrees C., 5-10 minutes; at 225 degrees C., less than 5 minutes; these are optimum values.

The advantages of the higher temperatures have to be set against the tendency of the p.m.m.a. to ooze from the mould, decompose or distil, and to develop opaque areas. Cooling can be by any convenient means. There is no tendency to stick to the mould if the coating is dried tack-free before assembling.

Particular applications for the coated product are mentioned, viz., aeroplane windows and turrets, windows for tanks, automobiles and houses, optical parts such as lenses and prisms, enclosures for instruments and meters, temperature indicators, etc. The tendency for p.m.m.a. to retain static charges and to pick up fibre and dust is greatly reduced.

The process as indicated from the foregoing details is one that is simple in itself, but which demands precision control in numerous respects if success is to be achieved. However, this is in accord with the nature of the material and components for which it is designed, and with the character of the objects to be achieved. At the same time it shows the possibilities of other silica bonded coatings produced along similar and perhaps simpler lines, for other base materials and objects.

PLASTICS IN PARLIAMENT

Meta-rich Cresylic Acid

In the House of Commons on October 11, Lieut.-Colonel Sharp asked the President of the Board of Trade whether he will increase the allocation of meta-cresol to the plastics industry; how present production figures of meta-cresol compare with those of a year ago and in 1938; to what extent he estimates that they will increase; and to what extent supplies available for British industry are being augmented by imports or reduced by exports.

In a written answer Mr. Shinwell said he assumed the question related to cresylic acid of high meta-cresol content. His Ministry works closely with the tar-distilling industry to secure the maximum amount of meta-rich cresylic acid of grades suitable for the plastics industry from the crude tar production of the country. There is no system of allocation in operation. Production in the first half of 1946 was approximately the same as in the first half of 1945. Statistics for 1938 are not available, but it is known that meta-rich grades were not extracted to the same extent as they are at the present time. As production depends in the first place upon the amount of coal carbonized, it is not expected that there can be any appreciable increase under present conditions. No meta-rich cresylic acid is exported, and there is no known available source of supply for import.

SURFACE PROTECTION AND ADHESION

A New Synthetic Emulsion

IT is well known that one of the chief defects of emulsions is the fact that, besides the water and the emulsified particles, they contain a third substance—the emulsifying agent (together with a stabilizer)—which remains in the dried film, adversely affecting its properties.

In general, the emulsifying agent is water-soluble and remains so, with the consequence that the film is attacked more or less readily by water. A new emulsion has now appeared on the market with properties which are rightly described as unique. In the first place, it yields a water-resisting film. This is achieved by a process at once ingenious and novel. We set it out at some length, as it represents a notable stride forward in emulsion-making technique.

The emulsion is of the phenolic resin-in-water type, which, of course, allows of its being diluted to any desired extent with water; the size of the resin particles is of the order of $\frac{1}{2}\mu$, where $\mu = 0.001$ mm., i.e., they are so small that they exhibit Brownian movement, being pushed about by collisions with the surrounding water molecules. The diluted emulsion also exhibits the Tyndall effect. It will therefore be appreciated that neither creaming nor settling occurs, no matter how long the emulsion is stored.

During manufacture, the surface of each tiny particle of resin becomes covered with a monomolecular elastic layer carrying a negative electric charge. It is this layer which prevents coalescence of the droplets of the emulsion, aided by the mutually repellant electric charge on each.

When the emulsion is spread in a thin layer and exposed to air, the water commences to evaporate. Matters are so arranged that when a loss of about 33 per cent. has occurred a change comes over the interfacial layer, which loses its charge and simultaneously becomes rigid.

Since the properties of an emulsion are governed by the properties of the interface, this alteration in the character of the interface naturally causes a change in the emulsion. The outward sign is a sudden increase in viscosity, betokening a reversal of the phases. The resin is now the external, continuous phase and the water is distributed in droplets throughout the resin.

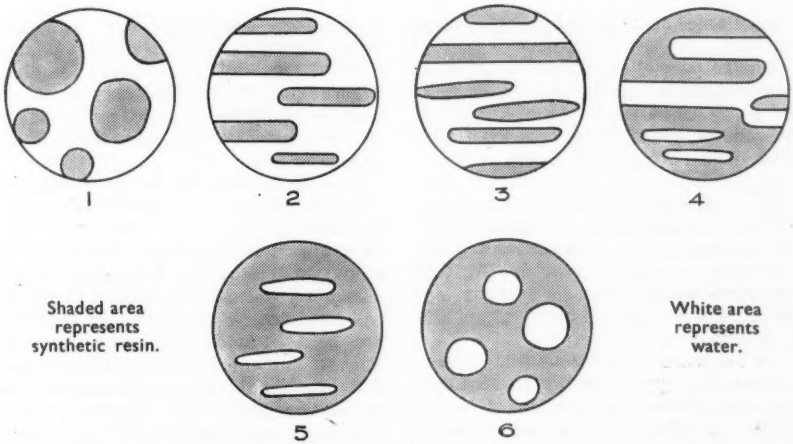
In this condition of water-in-resin emulsion, the resin is no longer "soluble" in water. Moreover, the alteration in the character of the interface is the release mechanism for the initiation of a chemical reaction between the minute quantity of emulsifying agent present and the stabilizer in the emulsion. The speed of this reaction is exponential and strongly stimulated by ultra-violet light, so that in an hour or so after application nearly half the quantity of emulsifier and stabilizer present disappears by a mutually destructive reaction.

It therefore follows that the newly formed film quickly becomes hydrophobic or water repellant. Any water falling on it must first get at the traces of stabilizer and emulsifier inside the film, and even then it cannot remove the film as its first effect is to form a water-in-resin emulsion and this it can only do with difficulty.

After a few days' exposure to light the bulk of the stabilizer and emulsifier has disappeared by a process of mutual destruction, quantities being so calculated that no excess of either remains. The film therefore possesses a high degree of resistance to water, as well as attack by chemicals and oils, either hot or cold.

One of the chief drawbacks of almost all emulsions thus eliminated, it will be realized that large new fields of exploitation are opened up, including adhesives, textile treatment, binders for plastic masses, and surface protection.

No generalizations can be made on



Electrical changes and reversal of Krux synthetic resin emulsion during drying, as seen under microscope.

(1) Krux synthetic resin emulsion: particles have a negative charge on surface. (2) Resin droplets elongate as the water evaporates. (3) They become thread-like as they lose their negative charge, and (4) then partially join up because they no longer repel each other, (5) while the water, decreasing in volume, contracts and breaks up. (6) Finally, assuming a spherical condition, the Krux synthetic resin becomes the continuous phase instead of the water, the interface now being neutral and rigid instead of charged and fluid.

adhesives; each specific problem has to be worked out separately. This emulsion has specific powers of adhesion to glass, which is a difficult substance to stick together, in the ordinary way. Among other uses, the emulsion provides a good adhesive for glass fibres. In this connection it is to be noted that many adhesives for glass behave erratically, probably due to adsorption of different substances on the glass surface. The new emulsion is remarkable in that its adhesion appears to be very uniform, probably due to its good wetting properties.

The emulsion is neutral, but its pH value may be increased by the addition of alkali, and also somewhat depressed if suitably buffered. Unlike many emulsions, it is not attacked by bacteria or moulds.

The deposited film is glossy and transparent. It will not redissolve in water, although prolonged contact with water may cause it to become detached from any rigid non-absorbent base in exactly the same manner as a linseed-oil film gradually loses its adhesion when immersed in water. Unlike most emulsions, even when pigmented, it still dries with a highly lustrous surface.

As it is not attacked by bitumen, the new emulsion can be employed as a protective glossy film (with high abrasion resistance) on the surface of bitumen floors, bitumastic decking, and the like. It possesses a further advantage in that, if after prolonged use wear marks begin to show, they may be removed without having to go over the whole surface. Because of its inertness to most substances which normally attack protective coatings, the emulsion forms a valuable seal against pitch and bitumen.

One of the outstanding properties of the emulsion is its ability to resist absorption into porous surfaces. It may therefore be used as a sealer or as a surface coating for pressed pulp-ware, rough fibre board, plaster-of-paris, vulcanized fibre, cardboard, paper, brick, blotting paper, soft wood, cement, stucco, hard asbestos or soft asbestos sheet, heat

insulation, showcards and similar types of surface.

Unlike normal protective media, being an emulsion it may be applied to damp or even wet surfaces without danger of subsequent blistering or peeling. One coat on a porous surface will be found equivalent to several coats of the solutions commonly used for coatings. New softwood is particularly troublesome for the application of a protective coating, as it absorbs with avidity. Not so with this new emulsion; toys, for example, may be given a protective film in one application without difficulty.

In this connection the emulsion is very suitable for application by barrel tumbling, in which the articles, of wood, plastic or other material, are placed in a tumbling barrel, together with the medium, either pigmented or unpigmented. Quantity of medium and number of articles must be regulated with some care. Final drying is carried out by shaking in a sieve, sometimes aided with a current of warm air.

The new emulsion forms a suitable adhesive for the flock-spraying process, because it is water resistant, non-inflammable and non-toxic. It is applied to the surface of the article and when nearly dry the flock is applied as usual.

A considerable amount of information has been gathered concerning applications of this new method of surface protection and adhesion, and is available on application to Bryson Processes, Ltd., Irthlingborough, Northants.

Prizes Offered in Plastics Industry

THE Council of The British Plastics Federation, as administrators of the Bowen (Cables and Plastics) Prize Fund, offer three prizes, to the value of £50 each, for award in June, 1947.

The prizes will be awarded for original scientific contributions in chemistry, physics, engineering, or chemical engineering of post-graduate standard, and having a bearing on the plastics industry. Two of the prizes will be open for competition only for employees, of not less than twelve months' service, of member firms of The British Plastics Federation. One prize will be open to anyone domiciled in Great Britain.

Authors of contributions for the open prize, if not employed by an industrial undertaking, should state their occupation. If authors of contributions for the open prize are employed by member firms of the Federation, they should also submit a letter from their employers giving them permission to submit the contribution.

Contributions should be sent to the General Manager, British Plastics Federation, 47-48, Piccadilly, London, W.1, to reach him not later than first post on Saturday, March 29, 1947. It is the desire of the Council of the Federation that all suitable contributions submitted for these prizes shall be published.

The Council of The British Plastics Federation, as administrators of the Worshipful Company of Horners Prize Fund, also offer three prizes of the value of £15 each, for original craftsmanship for (1) design for a mould, (2) production of a mould or die in wood or metal, or (3) drawing for the general arrangement of a moulding tool. These prizes are open to employees of not less than twelve months' standing with member firms of The British Plastics Federation, from whom further information can be obtained. All entries have to be submitted before March 29, 1947.

I.P.I. Prize Papers Competition

The Western Section Committee of the Institute of the Plastics Industry have arranged a competition to encourage members to take an active interest in the reading of papers at Section Meetings. The competition will be divided into two groups: (a) ordinary members; (b) junior members. It will be open to all Sections of the Institute. Two prizes of £5 5s. and £3 3s. will be offered in each group. Winners will be expected to read their papers at the meeting of the Western Section, March 27, 1947. Papers must be limited to not more than 3,000 words. All entries must reach the Hon. Secretary of Western Section, Mr. J. H. Collins, c/o Erinoid, Ltd., Stroud, on or before February 10. Entries will be judged by the Western Section Papers Committee, whose ruling shall be final. The Committee considers that, provided the subject of the paper has a direct bearing on plastics, competitors are free to consider such matters as applications, advertising, decorative aspects, etc., as well as purely technical considerations.

LETTERS TO THE EDITOR

Advertising Posters

Sir,—We read with interest a letter in your November issue relating to advertising posters.

We specialize in the coatings of papers with copolymers of polyvinyl chloride acetate, and our materials are capable of withstanding the rigours of the English climate since they retain the property of complete waterproofness, even when submitted to reverse folding and creasing under quite heavy weights.

The smoke-laden atmosphere of our large cities has an appreciable acid content, and the outstanding acid resistance of the copolymers is noteworthy. Our process is continuous, and we are convinced that the top lamina of a poster, if made from our coated material, would have a very long display life. It would be necessary for the coated paper to be sheeted after processing by us, and to be printed with vinylite inks that have been specially developed for us.

Our process is also applicable to the production of showcards, since the coating is completely unaffected by oils and greases. We mention this fact since another of your correspondents has inquired for a plastic material to be more durable than ordinary cardboard.

LEONARD STACE, LTD.

York Place,
Swindon Road, Cheltenham.

Supports for Electrolytic Work

Sir,—Are there available plastic rods or tubes which could be employed to support small objects in an electrolytic bath during deposition of metals? Would they be strong enough, and would they be acid-resisting?

London. A.C.A. and Co., Ltd.

[EDITOR'S NOTE.—We believe that simple phenolic extruded rods would be reasonably useful, although we are quite unaware of the probable life in an existence open to acid splashes. Inquiries should be made of F. A. Hughes and Co., Ltd., who are sole producers of this type. Cast phenolic rods (made by Catalia, Ltd. and United Ebonite and Lorival, Ltd.) should also be interesting. In another category the rod made from resin-impregnated laminated material (e.g., that made by New Insulations, Ltd.) should prove highly resistant and extremely strong. Based purely on acid-resisting properties, polythene (I.C.I., Ltd.) should prove the best, and is available in rod form. Since it is both tough and resilient, it would be necessary to have a strengthening core of, say, thin metal rod to maintain rigidity.]

Pickle and Jam Containers

Sir,—We understand that experiments are being made to produce transparent plastics pickle and jam containers for commercial use. We would be grateful for information on this subject, or if you can help us in any way.

CROSSE AND BLACKWELL, LTD.

London, W.1.

[EDITOR'S NOTE.—Pre-war, there was much talk of producing transparent containers by injection, for the above and similar purposes replacing glass. More recently experiments have been carried out on the blowing process. One concern with thorough knowledge of this latter method is BX Plastics, Ltd., with which company contact should be made. If the job is possible by injection, that is, of the order of simplicity of a transparent beaker, there is a much wider selection of factories.]

Electrical Meter Cases

Sir,—Our Indian works, while large consumers of moulded cases for voltmeters, ammeters, etc., have so far purchased these from British and Indian manufacturers. It is now desired to manufacture these items at our Indian works. Could you advise us what raw materials and equipment are required for this purpose. To commence, we should require an output of, say, 500 cases per week. These would measure about 3½ by 4 by 3 ins., and would be used for desk-pattern meters.

ORIENTAL SCIENCE APPARATUS WORKSHOPS.

325, Glasgow Road,
Blantyre, Glasgow

[EDITOR'S NOTE.—The inquirers will understand that technical problems of this type are rightly the province of consultants, to whom we refer them. We have also given them names of manufacturers of plant and raw material.]

New-type Shelf Bracket

Sir,—I should be very much obliged if you would give me the names of any firms likely to undertake the making of a new-type shelf bracket in plastics, also likely suppliers of the necessary plant for making such an article. The bracket is of a new design, for which a provisional patent has been taken out. The bracket is simple to manufacture, with no moving parts or screw threads. It is suitable for supporting shelves of wood, glass, metal, or other materials in household use, or as shop-fitting. A. F. MARLOWE.

Hamrod House, Westonzoyland,
Somerset.

[EDITOR'S NOTE.—We regret that in inquiries of this type we cannot give adequate replies, because of the implied economic problems. We publish it, however in the event that interested manufacturers may care to contact the inquirer direct.]

Self-adhesive Identification Labels

Sir,—Will you please let me have the names and addresses of manufacturers of self-adhesive identification labels produced in one-colour, two-colour, and three-colour printing, punched to shape, and with good adhesion to metal.

J. MCGOWAN.

6, St. Michaels Court,
The Riding,
Golders Green, N.W.11.

Machinery and Moulding Powders

Sir,—I am interested in obtaining machines for the production of moulded articles; also moulding powders for use on these machines. I have written to several makers in the U.K., but I cannot get any reply. Your assistance in obtaining offers of machinery and moulding powders would be appreciated.

C. T. STERN.

Marinha Grande,
Portugal.

Marking Presses

Sir,—We are looking for a small hand or treadle press for marking the plastic handles of toilet brushes, i.e., fixing or applying our trade marks, etc. We desire to do this using a roll of gold paper, and for the dies of the press to be electrically heated. UNIVERSAL BRUSH CO.

Stockingstone Road, Luton, Beds.

Exports for Spain

Sir,—We are importers of materials for the plastics industries, and should like to contact British manufacturers regarding polystyrene, polyvinyl acetate and cellulose acetate for export.

PRODUCTOS AMERICA.

P.O. Box 5,184,
Barcelona, Spain.

Improved Plaster of Paris

Sir,—Will you kindly let me have some information on the use of plastics in improving plaster-of-paris, especially for building purposes. I understand that such products can be made almost as strong as stone and are waterproof when used for rendering. A. BOIREAU.

5, Rue Douamont,
Sétif, Algeria.

"Plastisols"

Sir,—We read in an American Digest of powdered vinyl resins suspended in a plasticizer, and that these "plastisols" can be moulded without pressure. Can you give us any information regarding the manufacturers of such material?

NEW DIE, LTD.

28, Bartholomew Close,
London, E.C.1.

[EDITOR'S NOTE.—We regret we have no further information upon this matter. Our correspondent apparently has seen the reference in "The McGraw-Hill Digest" for October, 1946 (page 16), giving an excerpt from the current issue of "Business Week." The "Plastisols" are there described as "powdered vinyl resins suspended in a plasticizer." Being fluid, they can be applied to textiles in almost any film thickness with simple roller or knife coating equipment. It is also stated that they can be moulded without pressure, and that heat treatment at 300-350 degrees F. converts them into a finished resin.]

Plastics in Denmark

Sir,—You were kind enough a short while back to make inquiry concerning the present position of the plastics industry in Denmark. Accordingly, I am offering a few comments which may be of particular interest to your English readers.

Conditions in Denmark are not too good, due to the fact that we get very small amounts of moulding powders from Britain and none from the United States, although Sweden is supplying a few tons of melamine resins. The Danish production of phenolic moulding powders is very small.

Our one cable factory is very interested in vinyl resins, nylon and polythene, but have not yet commenced using these materials.

Compression moulding is the most common technique employed in Denmark, although injection moulding is gaining ground. Only two companies are producing laminated materials, in both cases of the phenolic type with paper or cotton-fabric base. Transfer moulding has been known for many years, but is seldom used, due to the fact that we do not have the special transfer moulding presses.

Extrusion is used only in the rubber industry, and not in the production of rods and tubes of normal plastics. The jet moulding, post-forming, low-pressure and contact moulding methods so far are not being used in Denmark. Indeed, until recently, these methods were unknown here, and even now the necessary machines and materials are not obtainable.

The evolution of the Danish plastics industry has, until this year, been very slow, probably because most of the companies concerned are started and run by business people without the assistance of technicians. Knowledge of plastics as a whole is very small; indeed, many people are of opinion that plastics are materials having almost magical properties. After large quantities of p.v.c. sheeting, made from scrap, had been imported from Britain, there was a certain aversion to plastics. Nevertheless, there is now ever-increasing interest again, especially among people with technical knowledge and industrialists.

I am sure that as soon as the conditions of our foreign trade improve, we shall get rapid development in our plastics industry. C.D.

Denmark.

Phenols for Moulding Powders

Sir,—There appears to be a misstatement of fact in Mr. Fleck's paper—that benzol is in short supply. The normal pre-war disposal of benzol was approximately 80 per cent. to motor spirit and 20 per cent. to the chemical and allied trades. The latter covered the production of pure and 90's benzol, toluol, xylol and naphtha.

With the cessation of exports to America the position is approximately the same, and there is no difficulty in the chemical trade taking most of the benzol produced in the country if they can utilize it. The dyestuffs and other consuming industries have never been short of benzol, and any synthetic phenol production based on this raw material is not likely to be jeopardized by a shortage of benzol.

It is true the recovery of benzol may be falling through difficulties in regard to fuel, but we have not yet reached the stage when benzol for the chemical trade is suffering in a like degree to most of the other products emanating from coal.

Earlsfield, S.W.18. F. R. KING.

Nylon Waterproof Cloths

It is reported from France that Rhodiaceta (a branch of Rhône-Poulenc) is producing a fabric from nylon for the production of waterproof cloths. The interesting point about its manufacture is that the fabric is put through a calender with a top hot roll and a bottom cold roll. The top roll heats the surface to such an extent as to result in the formation of a thin, continuous, smooth film of nylon, which is one with the basic woven material. The latter retains the well-known high strength of nylon.

TECHNICAL NOTES ON WET STRENGTH PAPER

An article on the wet strength improvement of paper was published in "Plastics" for April 1946 (page 173). We give here some additional notes regarding the application of resins which have been developed by Aero Research, Ltd., in this connection.

OVER 40,000 tons of wet-strength paper have now been made with the water-soluble synthetic resins which Aero Research, Ltd., introduced in 1945. This "wet-strength paper" promises to do for the paper industries what "resin-bonded plywood" has done for plywood; hitherto, both plywood and paper suffered from the major defect of poor water resistance.

"Wet-strength paper" is not impermeable to water. It is no different in appearance from untreated paper, but it retains up to 50 per cent. of its dry strength after prolonged immersion in water. Photographic paper, filter paper, paper towelling, paper sacks, wrapping paper, map paper, board linings, cloth substitutes, and base paper for impregnation, are examples which benefit from the possession of wet strength. Some interesting details of the resins employed are given in Aero Research Technical Notes No. 43.

Resin 70 is mainly used for the production of wet-strength Kraft. An addition of 1 to 2 per cent. of the weight of the bone-dry pulp gives satisfactory results. Table I shows the effect of increasing the amount of resin; figures represent average breaking length in metres obtained from production runs in six mills. The furnish used was 65 per cent. unbleached Kraft and 35 per cent. waste paper. It will be seen that the addition of 2 per cent. of Resin 70 gives a significant increase in dry strength and a fivefold increase in wet strength. The improvement in dry strength suggests the possibility of "up-grading" a furnish of low quality.

The resin, containing about 70 per cent. solids and with pH value 7 to 8, can be added straight into the beater; if diluted with water to 50 per cent. solids, it may be added to the chest or headbox. In order that the resin may be retained on the fibres and condensed, it is necessary to lower the pH of the pulp either before or after the addition of the resin; this is usually done by the addition of alum, which simultaneously precipitates the resin.

The pH of the water on the machine must not exceed 5; if the alum addition fails to lower the pH to this value, small amounts of sulphuric or hydrochloric acid may be used.

The "curing" of the resin depends upon time, temperature and pH. A high temperature, a long time of drying, and a low pH will facilitate curing. Speaking generally, provided the pH is less than 5, conditions which result in drying the paper down to a moisture content of 4 per cent. also correspond to a temperature-time integral sufficient to cure the resin. Full wet strength is not developed until the treated paper has matured for several days; such maturing is facilitated if the paper is wound hot.

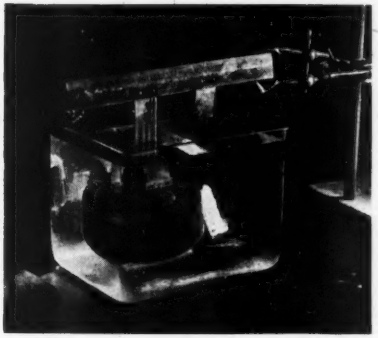
After the resin has set, the paper (in view of its acquired wet-strength properties) can be readily damped and 8 to 10 per cent. moisture can be reintroduced. The treated paper has excellent tear and folding properties, and retains dimensional stability under rapid humidity

Table I

Resin 70 added (per cent.)	Dry breaking length (metres)	Wet breaking length (metres)	Wet/Dry (per cent.)	Retention of resin in paper (per cent.)
0	6,100	520	8.5	—
1	6,340	2,120	33.5	65
2	6,900	2,700	39.2	46
4	7,050	3,000	42.5	40

(Right) Each of the two pieces of paper shown has been saturated in water and then rubbed ten times with the finger. The treated paper is slightly abraded, but the untreated is soon worn through.

(Below) Untreated paper broke under a weight of half-a-kilogram when immersed in water. The treated paper carries two kilograms indefinitely.



changes. No difficulty will be experienced in repulping the broke, which readily disintegrates by warm beating at low pH.

Where it is desired to add the resin in course of formation of the sheet on the paper-making machine, or where paper already made has to be given wet-strength properties, it is necessary to use a modified form of resin known as Resin 350.

Application on the machine is of much less significance than formerly, but there are some pulps, in particular highly bleached sulphites, which show a rather poor retention of Resin 70 as added to the heater. Under these conditions Resin 350, when applied to the paper at a point where the water content is of the order of 70 per cent., will still produce excellent wet strength properties. Here the resin can be sprayed on the wet web, or alternatively applied by a system of rollers. Conditions of pH and drying are the same as for Resin 70.

Resin 350 also enables the paper converter to obtain a variety of useful properties distinct from mere wet strength. For example, it has been extensively used for tub sizing with or without additions of gelatine, starch and like materials; considerable quantities of map and chart paper were made in this way during the war. It is also possible to spray diluted Resin 350, in place of the usual damping water, prior to calendering; the heat of the calender rolls is then normally sufficient to cure the resin. High wet strength products obtained in this manner fulfil many of the functions of the so-called vegetable parchment.

BRITISH STANDARDS INSTITUTION.

The Yearbook of the British Standards Institution, just published, gives a subject index and a synopsis of each of the 1,300 British standards now current. These standards have been prepared by representative committees of 44 different industries. Copies are obtainable from Publications Sales Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

PLASTICS EXHIBITION.—During its recent three weeks' run at Dorland Hall, London, the Plastics Exhibition organized by the "Daily Graphic" in association with the British Plastics Federation, attracted more than 52,000 visitors. Certain features are being sent to Australia in 1947 at the special request of the Export Promotion Department of the Board of Trade, for an exhibition to be held in Sydney.

RAW MATERIALS GUIDE.—The Board of Trade are publishing a revised Raw Materials Guide, which sets out all the raw materials controlled by them and by the Ministry of Supply, and gives brief details of the types of control in force and the addresses to which inquiries should be addressed. It is obtainable from H.M. Stationery Office, price 1s. 6d.

PLASTIC SHEETING.—Under the Consumer Rationing (Amendment) (No. 5) Order, 1946, a person who has plastic sheeting made up for him into rationed goods is required to surrender coupons on the supply to him of those rationed goods. The Board of Trade have now made a General Licence (S.R. and O., 1946, No. 1732) under which a trader no longer has to surrender coupons to another trader who makes up plastic sheeting into rationed goods on commission for him, except in respect of any rationed material which that other trader may have added in the process of making-up. Traders who make up into rationed goods plastic sheeting owned by members of the public must continue to collect coupons and account to the Board of Trade for them.

BRITISH INDUSTRIES FAIR, 1947.—The first post-war British Industries Fair will be held in 1947, from May 5 to 16. As in pre-war years, exhibits will be grouped in two main sections. The lighter industries in London and the engineering and hardware at Birmingham. There will be a much larger range of plastics goods than on any former occasion. The London section of the Fair is organized by the Export Promotion Department, Board of Trade, 35, Old Queen Street, London, S.W.1, and the engineering and hardware section by the Birmingham Chamber of Commerce, 95, New Street, Birmingham, 2.

BAKELITE, LTD.—Dr. R. F. Hunter, D.Sc., D.I.C., A.R.C.S., formerly Nizam Professor of Chemistry at Aligarh University, has been appointed to the position of research manager with Bakelite, Ltd., his new post to date from November 1, 1946. He will be responsible to Mr. G. Dring, a director of the company, who is in charge of the company's research and development activities. The Development Dept. will continue in charge of Mr. S. E. Chubb, as development manager. Dr. Hunter, whose department will be concerned with research work of a fundamental character, is a pupil of the late Professor Sir Jocelyn Thorpe. Previous to his Indian appointment, he held a Ramsay Fellowship at Imperial College of Science and Technology.

MENTMORE MANUFACTURING CO. LTD.—Mr. P. Marshall, formerly with Injection Moulders Ltd., has been appointed manager of the Plastics Division of this company, who are specialists in injection moulding for all trades.

MONSANTO CHEMICALS LTD.—Mr. Harold Driver, M.B.E., has been appointed company secretary. He joined Monsanto in May, 1946. Having been admitted as a solicitor in 1934, he was until recently Deputy Town Clerk of Oldham. Mr. T. P. Berington, late company secretary, will continue to act as an executive director of the company.

DE LA RUE INSULATION, LTD.—Large-scale production of decorative plastic material for distribution overseas is planned to begin early next year at a new factory now being erected at Tynemouth. The material will be produced under a licensing arrangement with an American company.

DERWENT PLASTIC MOULDINGS, LTD., of Stamford Bridge, are to open a new factory in York. The firm's products include component parts for cars, radios, and electrical and allied industries.

GROVEWELL RUBBER CO., LTD., have changed their name to Grovewell, Ltd. Originally makers of products in rubber, they have recently entered the field of plastic toys.

INDUSTRIAL WELFARE.—Important changes in industrial law have taken place recently as a result of such measures as the Industrial Injuries Act (which supersedes the Workmen's Compensation Acts), the National Insurance Act, and the revocation of the Essential Work Order. In this connection particular interest attaches to the postal course in Industrial Law which has been arranged by the Industrial Welfare Society. Particulars can be obtained on application to the Secretary, Industrial Welfare Society, 14, Hobart Place, Westminster, London, S.W.1.

A. C. WICKMAN, LTD., of Coventry, announce that, following their appointment as sole world agents for Diaplastics, Ltd., Goldhawk Road, London, S.W.12, designers and manufacturers of electronic equipment, a new division of their organization, the Electronics Division, is being established with Mr. F. L. Gladwin, late of Diaplastics, Ltd., as specialist-in-charge. The products already developed consist of complete H.F. equipment for plastic welding and dielectric and induction heating.

MANCHESTER OIL REFINERY, LTD. Certain staff appointments within this company have been adjusted as follows:—Mr. E. J. Dunstan, M.Sc., F.Inst.Pet., to be general manager; Mr. J. C. Wood-Mallock, F.Inst.Pet., M.I.GasE., to be refinery manager; Mr. H. L. Morris to be secretary. The managing directors of the company are Dr. F. Kind, Ph.D. (Vind.), M.I.Pet.Tech., and Dr. G. Tugendhat, LL.D. (Vind.), M.Sc. (Econ.) (Lond.).

GAUGE AND TOOL MAKERS' ASSOCIATION.—This Association is proceeding with its plans for the production of an export catalogue, to be published January next, in English, French, Spanish, Russian and Portuguese.

GAUGE AND TOOL MAKERS' ASSOCIATION.—The next in the series of luncheons for members of this Association and their guests will be held at the Savoy Hotel, London, on Tuesday, March 11. The chief speaker will be the Rt. Hon. Lord Woolton.

DR. PATRICK D. RITCHIE, at present head of the department of chemistry at Leeds College of Technology, has been appointed head of the department of chemistry at the Central Technical College, Birmingham. His post at Birmingham will include the direction of a new laboratory devoted to education in the technology of plastics.

CATALIN, LTD., of Waltham Abbey, have appointed Mr. A. H. V. Muirhead as general manager of the company. Mr. Muirhead has held for 10 years the senior executive position of secretary of the commercial and merchandizing organization of the Rootes Group.

BOARD OF TRADE Miscellaneous Goods (Prohibition of Manufacture and Supply) (No. 10) Order, 1946, removes the prohibition on manufacture and supply of certain goods. Among those which are entirely freed from control and which may now be made and supplied without a licence by any person are cutlery, spoons, forks, nail brushes, hair brushes and shaving brushes made wholly or partly of plastic material.

THOMAS DE LA RUE AND CO., LTD. The directors have declared an interim dividend of 10 per cent. (actual), less income tax, on account of the year ending March 29, 1947.

GERMAN PATENT SPECIFICATIONS. Over 70,000 German civil patent specifications, covering war-time developments in German industry and research, have been brought to Britain from the Berlin Patent Office and are open to inspection at the Patent Office Library, 25, Southampton Buildings, Chancery Lane, London, W.C.2. Photographic copies may be obtained at the rate of 6d. per page.

C. WALKER LITHERLAND, LTD., umbrella- and walking-stick manufacturers, announce that their Plastics Department has moved into new factory premises at Atlas Road, Darwen, Lancs.

GLASTICS, LTD., have acquired more commodious offices and showrooms at 24-25, Museum Street, London, W.C.1, to which address all communications should now be sent.

CANADIAN POLYSTYRENE PLANT.—The first polystyrene plant in the British Empire is now in production at Montreal, Canada, according to an announcement made by Monsanto Chemical Co. The new plant is part of the company's polystyrene expansion programme, planning for a total production rate of more than 80,000,000 lb. annually in early 1947. Approximately 95 per cent. of the equipment used in the new plant is of Canadian origin. Styrene, the basic raw material, is being purchased from the Polymer Corporation, of Sarnia, Ontario.

SCIENTIFIC FILMS.—A "Catalogue of Films of General Scientific Interest" has been compiled by the Scientific Film Association, 34, Soho Square, London, W.1, and published by Aslib (Association of Special Libraries and Information Bureaux). This is the first printed catalogue of scientific films to contain appraisals based on a definite system of grading, as well as full details of content and availability. Copies are available from the Association and from Aslib, price 5s. 3d., post free.

MR. HENRY J. ALTER has recently resigned from his position as export manager to Beetle Products, Ltd., and has now established himself as a consultant in plastics at 51, Seymour Street, London, W.1. He has been connected with the plastics industry in Great Britain and abroad for almost twenty years, and has recently returned from a trip to South America.

DENNY, MOTT AND DICKSON, LTD., of Adelaide House, London, E.C.4, inform us that their telephone number for all departments is now Mansion House 7961 (nine lines). The number previously advertised for the Plywood Department is no longer available.

MR. CHARLES MESLING, senior industrial liaison officer of the Council of Industrial Design, has resigned the appointment to join Allen-Bowden, Ltd., industrial designers and consulting engineers, of Leamington Spa. While on the staff of the Council of Industrial Design, Mr. Mesling was responsible for the liaison with the electrical and mechanical engineering and plastics and transport industries. Mr. Mesling intends to operate from London offices at 4, Lygon Place, S.W.1 (telephone, Sloane 7291).

LAMINATED PLASTICS

In view of the increasing demand for laminated plastics for building and interior decorating, the issue of a standard specification (B.S. No. 1323) for thermosetting synthetic-resin bonded-paper sheet for use in the building industry is welcomed.

This new specification covers sheet, made with phenolic-type resins, urea or other aminoplastic type resins, or with both, as supplied for use as wall-board or for veneering on wood or other surfaces in thicknesses from 1/32 to ½ inch. The specification lays down nominal dimensions and tolerances, together with requirements for appearance, flatness and for straightness of edges and squareness of rectangular finished panels. It also specifies cross-breaking strength, and resistance to impact, to water absorption, to marking (by hot water, alcoholic liquids or hot fats), to dry heat, damp heat and spread of flame.

Requirements for satisfactory machining qualities, and for certificates by manufacturers, are also given, together with full methods of test and additional information upon such properties as density, thermal conductivity, lack of action on metals and dimensional stability and upon recommended types of finishes which will be of the greatest interest to users.

B.S. No. 1323 may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1, price 2s.

OVERSEAS TRADE OPPORTUNITIES.

The following trade openings are reported from the U.S. Department of Commerce and other sources:—

Bruxelloise des Asphaltes (Bruda), 84-86, Rue Elie Lambotte, Brussels, desire quotation for bitumen-plastic products.

Laboratorio Malvyl S/A, Caixa Postal 23, Fortaleza, Ceara, Brazil, wish to import plastic boxes for rouge, lipstick, powder, etc. (Cable address Malvyl.)

A. Carvalho, Rua Franklin Tavora 340, Fortaleza, Ceara, Brazil, wish to purchase plastic materials.

Clovis, Fernandes and Cia, Caixa Postal 299, Fortaleza, Ceara, Brazil (cable address Elmer), wish to purchase plastic materials.

Cooperativa dos Funcionarios do Banco do Brasil, Rio de Janeiro, Brazil, wish to import plastics.

G. M. D'Andria, 4, Boulevard de Nieuport, Brussels, desire quotations for plastic buttons.

Hirzman, Goldensohn, Ltda, Rua Santa Luzia 799, 14th floor, Room 1403, Rio de Janeiro, Brazil, are interested in plastic materials.

Wealthy International Trading Co., Ltd., 4th floor, Yih-Hwa Building, Nanping Road, Kunming, Yunnan, China, is interested in importing plastics.

Sunierdas Saw Mills, opposite Reay Road Station, Bombay 10, are interested in plastics.

Middle East Mercantile Corporation, Jerusalem, Palestine, is interested in agency representation for plastics.

As from the issue of January, 1947, the price of "Plastics" will be 2s. monthly.

Plastics go to the dentist

Acrylic plastics' first appointment with the dentist was made by I.C.I. in 1935. In the familiar form of "Kallodent" and "Kallodentine" they are now universally used. Their success in this field is yet another example of the versatility of plastics.

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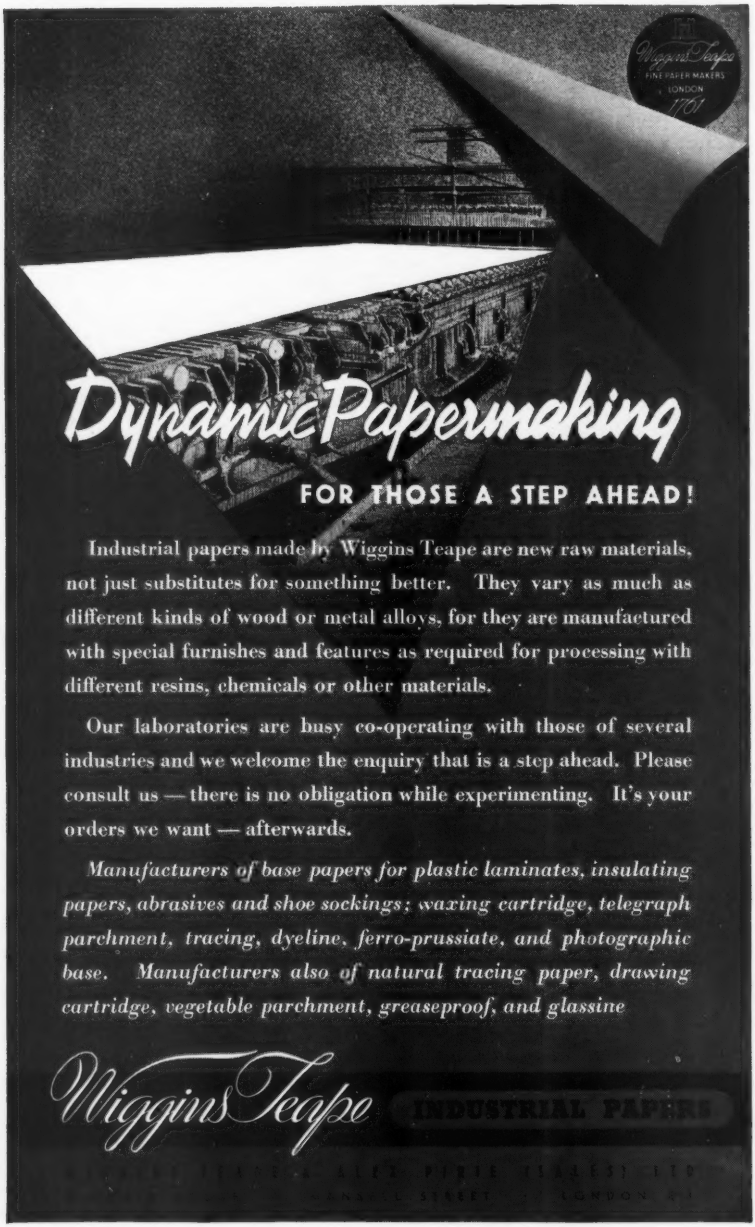
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FINE PAPER MAKERS
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Dynamic Papermaking
FOR THOSE A STEP AHEAD!
Industrial papers made by Wiggins Teape are new raw materials, not just substitutes for something better. They vary as much as different kinds of wood or metal alloys, for they are manufactured with special furnishes and features as required for processing with different resins, chemicals or other materials.
Our laboratories are busy co-operating with those of several industries and we welcome the enquiry that is a step ahead. Please consult us — there is no obligation while experimenting. It's your orders we want — afterwards.
Manufacturers of base papers for plastic laminates, insulating papers, abrasives and shoe sockings; waxing cartridge, telegraph parchment, tracing, dyeline, ferro-prussiate, and photographic base. Manufacturers also of natural tracing paper, drawing cartridge, vegetable parchment, greaseproof, and glassine
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INDUSTRIAL PAPERS

The Microscopic Examination of Plastic Materials

VI: Mouldings—(b) Fillers (Walnut Shell Flour) —contd.

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

IN the commercial production of walnut shell flour, it would appear that great care is taken to ensure the removal of all remnants of fins and lining. The material is then subjected to a sterilizing and cleaning process, this process presumably involving the use of somewhat elevated temperatures; if this be so, then the cutin content must of necessity suffer considerable reduction. Nevertheless, the main and most useful constituents of the shell, in the form of cellulose and lignin, appear to survive this treatment unimpaired. It is claimed, however, that the cutin remains untouched, and that, owing mainly to the presence of this constituent, the resulting flour possesses a low resin absorption. It is claimed further that the cutin content is responsible for the shell being entirely adsorbent and almost entirely non-absorbent.

In our previous examination of the walnut shell under the microscope, the greater part of our knowledge concerned the physical and morphological characteristics of the shell and its histological units, which latter were shown to be somewhat akin to those of the coconut shell. We also saw the results of producing a fine powder from the material by means of a saw, and the manner in which the structure of the shell broke down was discussed. But perhaps the most important conclusion arrived at was the heterogeneous nature of the shell, being, as it is, composed of tissues in three well-defined and differentiated locations.

The general nature of these tissues varied from the soft highly cellulosic thin-walled unit, to the massively thickened and highly lignified cell found on the peripheral layer of the shell. The powdered product was inevitably composed of these three types of units.

Having thus examined the raw material and a laboratory-produced flour, let us proceed to the examination of the commercial product. We see in Fig. 134 a photomicrograph of a sample of commercial walnut shell flour of 100 mesh, at a magnification of 160 diameters. The illustration gives a good general idea of the nature of the flour, showing it to be composed mainly of single cell units and groups of these units consisting of three or four cells. Two typical single cell units are shown at "A," while a fairly large group unit is indicated at "B."

The great difference in size of these two types of flour unit is very noticeable, but as groups of this size do not appear very frequently, the general size of the particle in this flour does not vary greatly from that of the single cell unit, although it must be remembered that even these latter vary in size in themselves.

Another point brought to light as a result of examining this flour is the consistency of the particle shape. These are seen to be tending towards the spherical shape. As we already know that the cell shape itself is almost spherical, this characteristic is not unexpected, even in the group units the general shape is seen to be strongly spherical. From the nature of this particle shape we may regard this flour as being of a granular type, distinct from the fibrous nature of wood flour. Therefore, at the outset we see very clearly the fundamental difference between these two types of fillers.

This difference must have an important

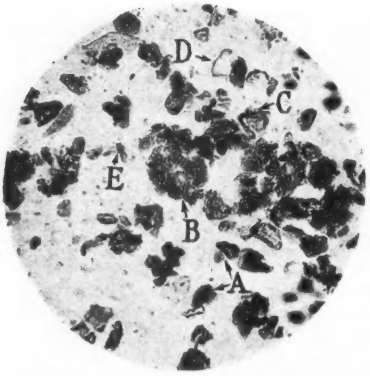


Fig. 134.—Walnut shell flour (commercial product 100 mesh). Mag. 160 diameters.

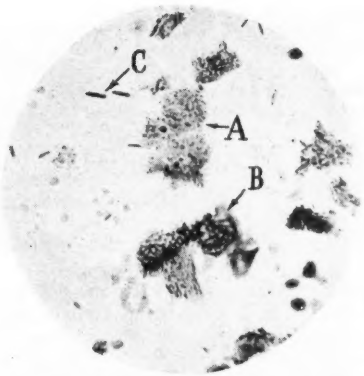


Fig. 135.—Walnut shell flour (commercial): extraneous matter. Mag. 450 diameters.

bearing on the behaviour of the flour, which appears in the form of lower tensile strength figures for this filler when compared to wood flour, although, in spite of the theoretical undesirability of this particle shape, it does appear to possess certain advantages when it comes to the question of impact strength, in which direction a decided improvement over wood flour is claimed for it.

A further study of Fig. 134 shows the presence of particles of the softer inner zone, one such being indicated at "C," where we see a typical thin-walled unit from this area of the shell, and, at the same time, particles such as that shown at "D" are also evident. These may be portions of the thin-walled elements, for a closer study will show numerous particles composed of portions of histological units as distinct from those composed of single whole units. Therefore, the particles in question (D) might conceivably be derived from the source stated, but they are more probably derived from small portions of the soft-finned lining of the shell, as they do not appear to be thick enough to be portions of thin-walled cells.

Another important factor of this illustration is the presence of a large percentage of extraneous matter appearing in the form of the fine powder making up the background to this illustration, such as the pieces marked "E." This is, in all probability, composed of small particles of a cellulosic nature and merely function as an impurity diluting the main material, and, as such, is, of course, somewhat undesirable.

As these extraneous particles occupy such a prominent position in the illustration, it would be as well to examine them more closely. In Fig. 135 we see a photomicrograph of some of these particles at a magnification of 450 diameters, from which it appears they are portions of the thin wall from the cell units of the soft tissue. At "A" we have a group consisting of what appears to be the entire bottom, or top, layer from a group of three small thin-walled cells; the nature of this wall when seen in plan view is clearly indicated as being a very lightly lignified membrane profusely covered with minute pits, which latter can be distinguished without any great difficulty. This structure is characteristic of the other units in this photograph, with the exception of that marked "B," whose structure shows it to be a portion of one of the more highly lignified structural units found in the hard tissue.

The main inference to be gathered from this illustration is that the majority of the extraneous matter in this flour con-

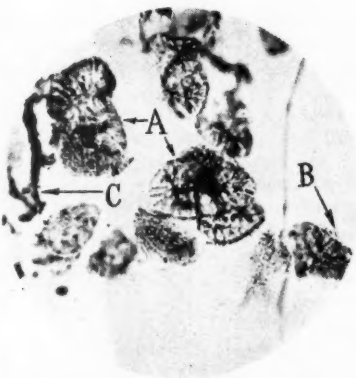


Fig. 136.—Walnut shell flour: elements from peripheral zone. Mag. 450 diameters.

sists of bits of thin-walled cells which are not rich in lignin, and, therefore, may be regarded as being cellulosic in nature, which characteristic condemns them from the point of view of being strength-producing constituents, although it should be borne in mind that they might conceivably possess a useful function in so far as being responsible for the production of resiliency is concerned.

In comparing the walnut shell flour with that obtained from the coconut shell, we strike a curiously anomalous condition, for in the walnut shell the hard tissue is actually harder than the coconut shell, and yet the flour from the former tends to produce a less-brittle moulding than that from the latter. This can only be due to the presence of the softer tissue in the walnut shell, all of which puts the question, of regarding the extraneous matter shown in Fig. 135 as an impurity, in a different light.

We now see that it might serve some useful purpose, but as against this it could be argued that the material is in too fine a state of division to be of any use. This could be true, due to its particle shape and its own non-fibrous nature.

There also appear in Fig. 135 some new bodies which we have not met before: these are the tiny constituents shown at "C," which resemble large bacteria. They are typical wax bodies and probably represent the various cutaneous substances in crystalline form.

In Fig. 136 we see some of the hard tissue elements at a magnification of 450 diameters. These flour elements will be seen to consist of groups of cells exemplified by those shown at "A," in which the thick cell wall and also the much-reduced cell cavity is clearly seen; likewise the pit channels proceeding through the cells are shown there. Two groups of cells illustrate very well the mode of break down of this material under grinding; this is quite different from the type of flour produced by means of a saw, as shown in Figs. 131 and 132 (see October issue), wherein the filing action of the saw teeth becomes apparent. The flour under discussion is stated to be produced by pulverizing or impact grinding, which method might be expected to produce a flour of the type shown, consisting mainly of the histological units or small multiples. In view of the nature of the structural details of the shell, this would appear to be the most suitable method of disintegration.

Thus we see that the nature of the raw material dictates the methods required for disintegration, if full advantage is to be taken of structural morphology.

In the walnut shell having three types of structural unit we are immediately confronted with a difficulty, inasmuch as the soft tissue requires a different method of disintegration from that required by the hard units, for we have seen that attrition grinding, whereby the material is "defibrated" rather than "chopped" up, is the best for soft woody materials. Thus it would seem that the pulverizing technique, although quite suitable for the hard portions of the shell, is not so desirable when applied to the spongy tissue.

This is possibly the basic reason underlying the presence of so much soft extraneous matter in the form of the portions of thin-walled cells already discussed. However, as the harder elements may be considered to compose some two-thirds of the volume of the shell, and, furthermore, as the extraneous matter has

been shown in all probability to function as a useful component of the flour, it is likely that this product is in a condition of optimum usefulness and is difficult to improve upon, particularly in view of the trouble of separating the tissues of the shell. Therefore it appears that pulverizing is the best method of breaking down walnut shell, as the majority of the tissue is treated according to the method dictated by its structure.

The type of particle produced in this flour does offer some scope for speculation on its effects in the final product, for we have seen that the main functional particles consist of either single cells or groups of two or three of these members making up a single particle. It is highly probable that the group particles have a modifying effect on the final strength of a moulding, inasmuch as their presence would probably tend to produce a differing stress distribution from that encountered when the flour consisted of single-cell particles in its entirety.

We have already seen (when dealing with wood flours) that the presence of large bundles of tracheids would produce localized stress concentrations which would have the general effect of producing a more uneven stress distribution throughout the structure of a given moulding, than would be the case if the filler consisted of single tracheids only. This modification appears to take the form of improved impact strength with an increased content of group units by virtue of the presence of larger shock-absorbing centres where these units occur. In other words, the presence of group units in the flour tends towards increased resilience, as a group of cells would possess greater shock-resisting properties than a single-cell unit.

Thus it would appear that the coarser the mesh the greater the impact strength of the moulding, although it should be borne in mind that the method of applying the shock has an important bearing on the strength of the material. The particular case in mind was the application of this material as a filler for press tool mouldings where the shock experienced by the moulding may be regarded as being almost purely compressional and not a combination of tensile and compression, as would be the case if the stress were applied in the manner of the Izod test, where the greatest stress is experienced as tensile on the side of the specimen on which the impact occurs.

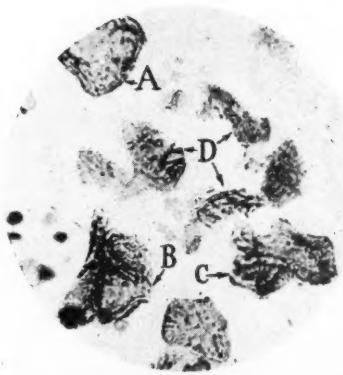


Fig. 137.—Walnut shell flour (commercial): flour units derived from intermediate zone. Mag. 450 diameters.

The illustration under discussion (Fig. 136) also includes some large particles of the so-called extraneous matter, one such being indicated at "B." These are seen to consist of portions of the pitted wall from large, thin-walled vessels, and are of the same composition as the smaller particles shown in the previous illustration. Included at "C" is a portion of a vascular bundle from the lining or fin substance; this is of a fibrous nature and should not be regarded as an undesirable inclusion.

So much for the hard, highly lignified tissue. Let us now examine the flour units derived from the intermediate tissue, which is composed of cells not so greatly lignified and possessing somewhat thinner walls.

In Fig. 137 we see a photomicrograph of some flour units from this tissue at a magnification of 450 diameters. These are shown at "A," "B" and "C"; that marked "A" is seen to be a fairly large

cell which is incomplete, nevertheless, the wall thickness of the cell is clearly seen, together with the pitted bottom wall which is seen in plan. At "B" we have portion of a group of cells similar to "A," although the individual cells forming the group are somewhat smaller and the two most in evidence are incomplete. "C" shows another cell of similar type, but in this case the wall thickness is greater than in the two previous cases. This illustration shows, in some measure, the type of flour particle to be expected from the breakdown of the intermediate tissue as a result of subjecting it to attrition or impact grinding. Being softer and less brittle in nature than the hard tissue, it does not tend to disintegrate into its component units so easily. We also find a tendency for the cells to break at their weakest point, which would appear to be the thinnest portion of the actual cell wall and not the junction between the two cells.

This type of breakdown will result in the irregular particle shape shown, which, in turn, may possibly function as a strengthening compound, especially as the irregularity of surface offers a good key for the resin and eases considerably the difficulties of thoroughly impregnating the particles which were apparent in the case of a tubular particle, such as a bundle of wood tracheids. The question also of the strength of this material, in tension, must not be overlooked, as it would have a considerable bearing on the ultimate strength of a moulding; thus, we should expect a slight increase in tensile strength as a result of the presence of these particles, due to their being somewhat stronger in this direction than the hard cells from the peripheral tissue.

In the centre of the illustration at "D" are some of the larger particles, which, for want of a better term, we previously classed as extraneous. They will be seen to be typical of this type of component found in the flour and have already been discussed in some detail.

From the foregoing remarks we conclude that the particles derived from the intermediate zone of the walnut shell very probably function as a useful resilience-producing element by virtue of their soft, though tough, nature, so that they would act as shock-absorbing centres, but it would appear that the content of this component is insufficient to meet the demands made upon it by the stress induced when it is used as a filler for presstool mouldings.

It is now proposed to examine a finer walnut-shell flour, stated to be 325 mesh. A sample of this flour is shown in Fig. 138 at a magnification of 160 diameters. It should be pointed out that this magnification is the same as that for Fig. 134, and, being such, immediately shows that there appears to be very little difference between the two mesh sizes, for in both samples the larger particles of group cells are present. These are shown at "A" in Fig. 138, but in the case of the 325-mesh material, the proportion of group cells is very much lower generally. This point is impossible to illustrate adequately by photomicrograph.

Although there is a proportion of the large flour elements present in the 325-mesh material, this is lower than that encountered in the 100-mesh flour. As a result of this, the proportion of single-celled units, as shown at "B" (Fig. 138), is higher, but the significant point of the

Fig. 138.—Walnut shell flour (commercial 325 mesh). Mag. 160 diameters.

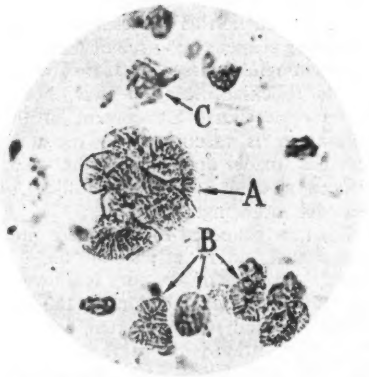


Fig. 139.—Walnut shell flour (commercial 325 mesh): hard flour elements. Mag. 220 diameters.

Fig. 140.—Walnut shell flour (commercial 325 mesh). Mag. 220 diameters.

comparison lies in the question of the presence of the group units in the material of finer mesh. This would seem to point to imperfect separation, as it is doubtful if these units would pass through a screen of that fineness.

On the other hand, we find in this fine-mesh flour a much larger proportion of the small extraneous bits, such as those illustrated in the group at "C." The proportion of this component is almost high enough to preclude the use of this mesh of flour as a filling medium; in fact, it is not recommended as such, but it does make the material a useful glue extender, from which point of view it will be discussed subsequently. Generally, the 325 mesh walnut-shell flour will be seen to consist of similar types of units to those found in the 100 mesh flour, although the proportions in which these components are found are considerably different, thus altering the characteristics of the flour.

The existence of these units may be confirmed by examination at a higher magnification. In Fig. 139 we see a photomicrograph of some of the hard elements at a magnification of 220 diameters, and a large group element "A" consisting of at least six cells. This unit is exceptionally large for this mesh of flour, and whereas there is a proportion of units of similar size in the material, this proportion is small and could be removed by further sifting.

An example of the type of flour element derived from the softer intermediate tissue found in this flour is shown in Fig. 140, at a magnification of 220 diameters. Here we see the element to be of the group unit type; in this case originally composed of a group of at least four cells. The size of this particle is consistent with it, being a component of the 100 mesh flour; but, recalling that large, hard particles were found in the 325 mesh material, the presence of these large, soft particles is not unexpected, owing to being more easily produced.

From the foregoing examination it becomes apparent that walnut-shell flour in general is not by any means a pure filler, in the sense that the flour does not consist of particles of the same shape and size; also the texture of the particles varies considerably, for hard granular particles exist side by side with others of a much softer nature derived from the transition tissue.

Assuming we could produce a flour consisting of the hard spherical particles only, then a moulding using this as a filler may be expected to be brittle and have a low tensile strength, similar to that experi-

enced when the filler is composed of spherical particles of, say, silica.

In the same way, if the flour consisted of nothing but particles derived from the intermediate zone of the shell, then the final product would be expected to possess somewhat better properties than the one before, from the point of view of brittleness and tensile strength, in as much as the particles in this case are more resilient and tend towards the fibrous in nature.

Particles consisting of thin-walled histological elements are lacking in strength in themselves, due chiefly to the small amount of ligneous material developed in their structure, in consequence of which the ratio of cellulose to lignin is much higher than that found in the hard units.

This characteristic might be assumed to have an adverse effect on the final strength of the moulding. This would also be apparent in a filler consisting of the extraneous matter alone; this material is so lightly lignified that we may regard it as being almost pure cellulose, in which case we may conclude that it would make a poor filler in itself. We have, however, seen that it is, in all probability, quite useful as a shock-absorbing medium, and as such possibly plays a useful role in walnut-shell flour, but owing to the general morphology of the particle, its strength in other directions would appear to be poor.

Walnut-shell flour consists of a mixture of the three constituents in approximately equal quantities, resulting in the production of properties different from those to be expected from each of the individual components, when used as a filler in themselves, the final result lying about midway between the properties of a wood flour filler and those conferred by a pure shell flour such as coconut shell.

This state of affairs is extremely interesting, for in this product we have a natural mixed filler in itself, and it gives us some idea of what may be expected by mixing fillers in general.

Choosing the correct resin for a moulding would run hand in hand with that of the choice of the most suitable blend of filling material, the net result being to enable the performance of any given moulding to be predetermined with a greater degree of accuracy.

In this respect, the use of walnut-shell flour offers a good example of the way in which the moulding characteristics may be altered to suit any particular function, for we have seen that when the moulding is required for press tool work the pure shell flour was unsatisfactory, but when blended with wood flour a better result was forthcoming. This may be looked at from the other point of view, in that a pure wood flour filler would not produce a suitable moulding, but required the addition of a proportion of walnut-shell flour in order that the compressive strength may be increased.

The possibilities of variations in the blending of fillers are very great and involve the consideration of numerous factors, each of which influences the final result as well as themselves. Varying properties may be expected when the particle size is not the same throughout any given mesh size; differences in proportion of mixed particle sizes will produce still differing properties in such a filler. All this can occur without any variation of particle shape or nature, so that if different mesh sizes also produce different shapes, further variation may be expected.

Although in most organic fillers the nature of the material is reasonably consistent, this is not always the case, as we have seen in our study of the walnut shell. Inconsistencies in the nature of the material have to be taken into account, these producing further differences in the final properties. Additionally, when two fillers such as walnut-shell flour and wood flour are blended, a further variation in the nature of the material takes place in each case, so that we have a material containing particles of four different types, i.e., the three types found in the walnut shell and the one in the wood flour. It will also be appreciated that variations in the proportions of these particles of different natures will produce corresponding variations of properties.

(To be continued.)

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

B.P. 579,983. Application date: 10.6.43. Accepted: 22.8.46.

Improvements in and relating to the Bonding of Rubber to Brass-plated Surfaces. C. M. Blow. To: John Bull Rubber Co., Ltd., and Metalastik, Ltd.

B.P. 580,035. Application date: 22.1.45. Convention date (U.S.A.): 22.1.44. Accepted: 23.8.46.

Improvements in or relating to the Production of Vinyl Cyanide. To: E. I. Du Pont de Nemours and Co.

Production of vinyl cyanide from hydrocyanic acid and acetylene in the vapour phase in the presence of an alkali metal cyanide catalyst.

B.P. 580,051. Application date: 4.3.44. Accepted: 26.8.46.

Improvements in or relating to the Reclaiming of Vulcanized Synthetic Rubber-like Material. D. F. Twiss and W. A. McCowan. To: Dunlop Rubber Co., Ltd.

Reclamation of a vulcanized mix containing synthetic rubber-like material of a GR-S class by comminuting the mix and heating it to a temperature of at least 160 degrees, continuously exposing fresh surfaces of the comminuted mix in the presence of oxygen and concurrently cooling and sheeting the heated mixture.

B.P. 580,078. Application date: 19.5.44. Convention date (U.S.A.): 29.12.43. Accepted: 26.8.46.

Thermosetting Plastics. To: Wingfoot Corporation.

Curing of vinyl chloride-vinylidene chloride copolymers by subjecting them to heat with or without pressure in the presence of a quaternary ammonium base or a weak acid salt thereof, or betaine. Magnesium oxide is used as an acid inhibitor and 2-10 per cent. of a heat hardenable phenol formaldehyde type resin may be added.

B.P. 580,088. Application dates: 15.2.43 and 8.12.43. Accepted: 27.8.46.

Improvements in or relating to the Production of Styrene and its homologues by dehydrogenation. H. M. Stanley, F. E. Salt, and T. Weir. To: The Distillers Co., Ltd.

Production of styrene, halogene substituted styrenes or their homologues by passing vapours of an alkyl substituted benzene hydrocarbon having an alkyl substituent group with not less than two carbon atoms or a halogene substitution product thereof in admixture with steam at elevated temperatures over magnesium oxide impregnated with vanadium oxide as catalyst. This catalyst must be substantially free from metals whose oxides are readily reducible by hydrogen to the metals. The catalyst may further contain china clay and an alkali metal compound (sodium hydroxide, sodium carbonate, acetate or nitrate). The improvement consists in an extended life of the catalyst so that revivification becomes necessary only after a few weeks, thus increasing the output of the plant.

B.P. 580,097. Application date: 15.2.44. Accepted: 27.8.46.

Improvements in or relating to Die Casting Machines for Moulding Material when in a Plastic Condition. H. A. Stock. To: Plasticast Development, Ltd.

B.P. 580,120. Application date: 12.4.43. Accepted: 28.8.46.

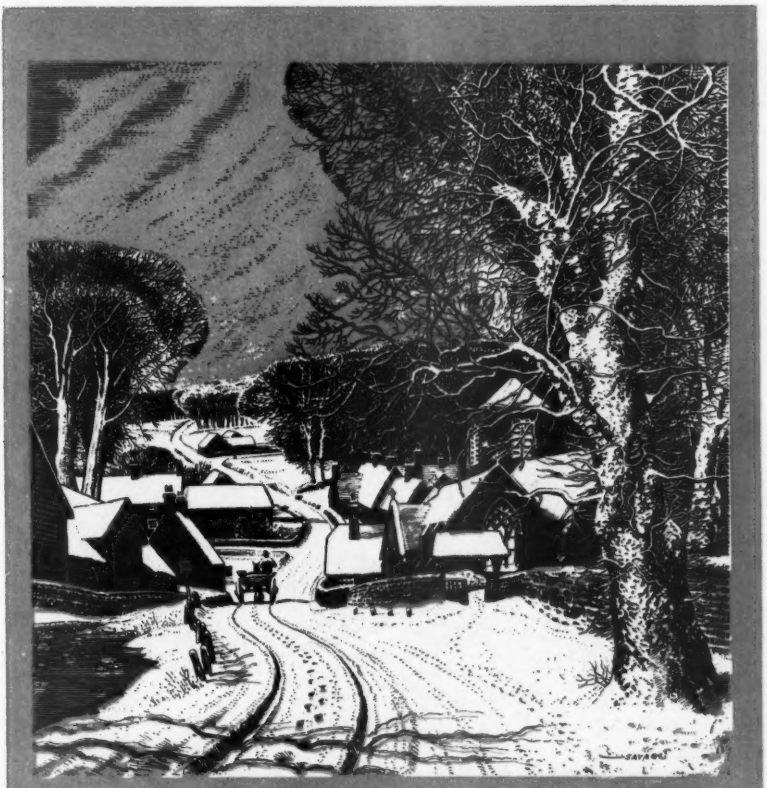
Improvements in the Manufacture of Modified Synthetic Resins. J. R. Alexander, D. Burton and F. Hausmann. To: William Walker and Sons, Ltd.

Oil modified alkyd resin prepared by heating a mixture of glycerol, phthalic anhydride and an oil (i.e., castor oil) containing colloidal graphite. Such resins may be incorporated into paper, cloth or asbestos for use in oil seals, washers, etc.

B.P. 580,155. Application date: 13.6.44. Accepted: 28.8.46.

Improvements in or relating to the Production of Material suitable for Flexible Films. D. F. Twiss and F. A. Jones. To: Dunlop Rubber Co., Ltd.

Material suitable for flexible films produced by treating a mixture containing natural rubber and a copolymer of butadiene and styrene with a halide (aluminium chloride, stannic chloride, hydrogen chloride, titanium tetrachloride), all of which affect the rubber, yielding a derivative with reduced extensibility but leave the copolymer unaffected.



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B.P. 580,182. Application date: 8.12.43. Convention date (U.S.A.): 9.12.42. Accepted: 29.8.46.

Improvements in or relating to the Polymerization of Olefines. To: E. I. Du Pont de Nemours and Co.

Polymerization of Ethylene.

B.P. 580,184. Application date: 17.2.44. Convention date (U.S.A.): 17.2.43. Accepted: 29.8.46.

Resinous Condensation Product and Method of making same. T. A. T. Grotenhuis and G. H. Swart. To: The General Tire and Rubber Co.

Solid rubbery condensation products which, when vulcanized, are resistant to cold flow, produced by forming a mixture of one or more saturated organic compounds and one or more organic compounds containing an olefin leakage or a hydroxy, amido, or amino group, each containing two negative constituents which are split off by alkali polysulphide to form an organic polysulphide. This mixture is then heated with an aqueous alkali polysulphide solution and the rubbery material so produced is separated.

B.P. 580,190. Application date: 16.6.44. Accepted: 29.8.46.

Improvements in or relating to Neoprene Solutions. A. March. To: B.B. Chemical Co., Ltd.

Refers to inhibitors for gelling. Neoprene solutions of this kind contain an organic solvent and maleic acid, maleic anhydride or malonic acid, also sometimes tri-ethanolamine or diphenyl guanidine.

B.P. 580,286. Application date: 16.6.44. Convention date (U.S.A.): 18.6.43. Accepted: 30.8.46.

Improvements in or relating to the Water Resistance of Shaped Articles comprising Polyvinyl Alcohol. To: E. I. Du Pont de Nemours and Co.

The water resistance and other physical properties of shaped polyvinyl alcohol articles are improved by heating these articles in an aqueous solution of a strong base (sodium hydroxide) at temperatures between 50 degrees and 90 degrees C. for a period of one-six hours. Articles of polyvinyl alcohol so treated are still soluble in boiling water, but insoluble and insensitive to water up to approximately 50 degrees C.

B.P. 580,250. Application date: 22.12.43. Accepted: 2.9.46.

The Production of Synthetic Resin Compositions of Improved Physical and Chemical Properties. W. E. F. Gates. To: Imperial Chemical Industries, Ltd.

Anti-static, anti-misting methyl methacrylate polymerizates. These properties are obtained by immersing sheets or mouldings of the polymer into an alkali bath and subsequently washing and polishing. Such sheets can also easily be dyed.

B.P. 580,275. Application date: 5.6.44. Convention date (U.S.A.): 5.6.43. Accepted: 2.9.46.

Thermosetting Plastic Compositions comprising Polyvinyl Acetal and Ketal Resins. To: E. I. Du Pont de Nemours and Co.

B.P. 580,310. Application date: 29.6.44. Convention date (U.S.A.): 12.4.43. Accepted: 3.9.46.

Olefin Polymerization. H. I. Wolff. To: Shell Development Co.

B.P. 580,333. Application date: 30.6.44. Convention date (U.S.A.): 3.8.43. Accepted: 4.9.46.

Improvements in or relating to Method of making Adhesive Compositions. M. E. Gross. To: B. F. Goodrich Co.

Refers to the manufacture of adhesive compositions, particularly for rubbery materials. It comprises condensation of a phenol and furfural to a fusible, soluble, partially condensed resin which is dissolved in a volatile organic solvent (methyl ethyl ketone); further condensation of the resin at a lower temperature in the presence of an acidic condensation catalyst (hydroxylamine hydrochloride) to a point short of which the resin becomes infusible; and, finally, adding to the resin solution so obtained a solution of vulcanizable rubber in a volatile organic solvent (ethylene dichloride). Such adhesives may be used for adhering rubber to metal, to plastics, to concrete and to wood, and they may also be used for bonding metals to one another.

B.P. 580,359. Application date: 22.11.43. Accepted: 4.9.46.

Divided out of B.P. 578,286.

Improvements in or relating to the Production of Cellulose Ethers. J. H. Sharphouse and J. Downing.

Cellulose ethers with improved resistance to heat consisting of cellulose ether (ethyl cellulose) and up to 10 per cent. of its weight of hydroquinone, the latter improving the stability of the cellulose ether.

B.P. 580,374. Application date: 16.3.44. Accepted: 5.9.46.

Improvements in Apparatus for Heating by High Frequency Electric Energy. J. C.

Quayle and P. Jones. To: British Insulated Cables, Ltd.

Concerns a more efficient and convenient form of heat treating insulating materials by high frequency energy which is especially useful in cases where the dimensions of the electrode system are such that they are a substantial part of a wavelength. The arrangement ensures that the electric and magnetic fields are confined and do not radiate energy, thus avoiding interference with other electrical apparatus and dissipation of energy from the apparatus.

B.P. 580,407. Application date: 29.4.43. Convention date (U.S.A.): 26.6.42. Accepted: 6.9.46.

Improved Process for the Production of Polymers and Apparatus therefor. To: Standard Oil Development Co.

Refers to the manufacture of olefinic polymers and in particular to continuous low temperature polymerization. The apparatus described consists of a polymerization reactor having a highly efficient refrigerating jacket surrounding a circulating system in which the polymer precipitates as a fluid slurry.

B.P. 580,433. Application date: 14.7.44. Convention date (U.S.A.): 15.7.43. Accepted: 6.9.46.

Improvements relating to Saponification of Cellulose Ester Materials. To: British Celanese, Ltd.

Production of regenerated cellulose by subjecting fibres, ribbons or films of cellulose acetate to complete saponification by means of an alkaline aqueous medium in the presence of a lower aliphatic aldehyde (formaldehyde, acetaldehyde, glycollic aldehyde) and a water soluble salt, i.e., sodium sulphate or potassium sulphate, which represses the swelling of the material.

B.P. 580,434. Application date: 6.9.44. Accepted: 6.9.46.

Improvements in or relating to the Production of Artificial Insolubilized Wet Spun Protein Filaments. R. H. K. Thomson and D. Traill. To: Imperial Chemical Industries, Ltd.

Insolubilization of coagulated filaments is carried out by means of formaldehyde in the presence of a strongly acidified saline solution.

B.P. 580,469. Application date: 16.10.44. Convention date (U.S.A.): 16.10.43. Accepted: 9.9.46.

Acetylene Tetraesters of Alpha-methylene Monocarboxylic Acids and Polymers and Copolymers thereof: To: Imperial Chemical Industries, Ltd.

B.P. 580,485. Application date: 26.10.42. Accepted: 10.9.46.

Improvements in or relating to the Purification and Compression of Ethylene. E. Hunter. To: Imperial Chemical Industries, Ltd.

This invention provides for the separation of ethylene from other gases by contacting the gas-containing ethylene with water at elevated pressure at a temperature between −5 degrees and 60 degrees C. for a sufficient time to allow at least part of the ethylene to be converted into solid ethylene hydrate, separating the residual gas or liquid and raising the temperature or lowering the pressure so that purified ethylene may be recovered from the solid ethylene hydrate.

B.P. 580,524. Application date: 14.10.41 and 24.10.41. Accepted 11.9.46.

Treatment of Polymeric Materials. B. J. Habgood, D. A. Harper and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

Refers to improvements of diisocyanate modified polyesters and polyester amides by heating such polymers with formaldehyde or formaldehyde liberating substances.

B.P. 586,537. Application date: 25.9.43. Convention date (U.S.A.): 28.9.42. Accepted: 11.9.46.

Method for improving Water Resistant Characteristics of Resins and Resinous Articles and Resinous Products resulting therefrom. To: Norton Grinding Wheel Co., Ltd.

Refers to abrasive articles bonded with primary aromatic amine formaldehyde resins. The improvement consists in lessening or eliminating the water attracting or absorbing properties of abrasive bodies by adding to the mix containing the primary aromatic-amine-formaldehyde resin and a polyhalogene compound, a substance selected from the following:—Lead, iron, zinc, copper, the oxides of lead, zinc, and cobalt, melamine, benzidine, sodium silicate, zinc borate, and salts of zinc, cobalt, gold and platinum.

B.P. 580,542. Application date: 13.12.43. Accepted: 11.9.46.

Improvements in or relating to Moulding Presses. Communicated by: F. J. Stokes Machine Co.

Arrangements for the automatic operation of moulding presses through a continuous succession of cycles involving a safety device for stopping the press automatically in case of improper operation.

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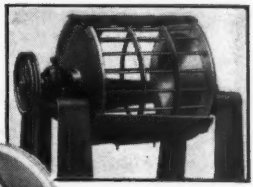

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B.P. 580,617. Application date: 10.7.44. Accepted: 13.9.46.

Process for reclaiming Waste Rubber. B. F. Dishon and F. G. Bergmann.

B.P. 580,665. Application date: 8.8.44. Accepted: 16.9.46.

Preparation of New Polymerizable Methacrylic Esters and Polymers and Interpolymers thereof. J. W. C. Crawford and R. H. Stanley. To: Imperial Chemical Industries, Ltd.

New Polymerizable methacrylic compounds produced by reacting methacrylic acid, its anhydride, acid chloride or methyl ester with trifluorethyl alcohol or 2.2.2-trifluoroisopropyl alcohol in the presence of a strong acid.

B.P. 580,729. Application date: 5.2.42. Accepted: 18.9.46.

Improvements in the Manufacture and Use of Plastic Compositions. H. A. Tunstall and W. F. O. Pollett. To: W. T. Henley's Telegraph Works Co., Ltd.

Improved form of plasticized polyvinyl chloride, which has a strength similar to unvulcanized rubber and can be worked on ordinary rubber machinery. At normal room temperature this type of polyvinyl chloride is in a plastic condition, but it can be converted to a tough elastic form by simple treatment. The compound consists of polyvinyl chloride, a plasticizer, and another polyvinyl resin soluble in the plasticizer. Compounding is carried out at a temperature below that at which polyvinyl chloride gels in the plasticizer. The compound is formed to the required shape and subjected to heating for a short time to effect gelling of the polyvinyl chloride. Suitable polyvinyl resins are: polyvinyl acetate, copolymers of vinyl chloride, and vinyl acetate, and polyvinyl acetals.

B.P. 580,731. Application date: 5.10.42. Accepted: 18.9.46.

Improvements in or relating to the Manufacture of Polymerization Products. P. W. Denny. To: Imperial Chemical Industries, Ltd.

Refers to the manufacture of polymerization products from vinyl chloride, and in particular to a product of improved colour stability obtained by adding to the emulsion used in the polymerization a small proportion of formaldehyde (.005 – .025 part by weight for every part of vinyl chloride).

B.P. 580,743. Application dates: 5.10.43 and 5.4.44. Accepted: 18.9.46.

Improvements in or relating to the Manufacture of Expanded Thermoplastic Materials. A. Cooper. To: Expanded Rubber Co., Ltd.

Expanded polyvinyl chloride or copolymers thereof prepared by forming gas bubbles in a gel of the said polymer and a plasticizer which has no appreciable solvent or swelling action thereon at normal temperatures, but swells it and forms a gel at elevated temperatures. This gel is subsequently heated sufficiently to enable it to retain its cellular formation. Diazoamido benzene is used as a blowing agent.

B.P. 580,748. Application date: 25.11.43. Accepted: 18.11.46.

Improvements in the Manufacture of Vinyl Ethers. W. J. R. Evans. To: Imperial Chemical Industries, Ltd.

Manufacture of vinyl ethers (excluding N-butyl ether) by reacting acetylene and an alcohol (other than N-butyl alcohol) with a potassium alkoxide dissolved or suspended in a secondary or tertiary aromatic amine (methyl aniline, dimethyl aniline, ethyl aniline, benzyl aniline, etc.) at low pressures and at a temperature between 150 and 250 degrees C.; anti oxidants may be added.

B.P. 580,855. Application date: 4.2.44 Accepted: 23.9.46.

Removal of Stresses from Thermoplastic Resin Articles. C. H. Crooks, W. A. Greenwood, D. Starkie, H. Silber. To: Imperial Chemical Industries, Ltd.

Refers to the removal of internal stresses in castings, mouldings, and shapings of thermoplastic resins by heating these articles in an inert liquid, i.e., glycerol, at elevated temperature and then cooling them slowly and uniformly. This Patent refers particularly to optical components made from polymethyl methacrylate and polystyrene.

B.P. 580,899. Application date: 1.9.44. Convention date (U.S.A.): 2.9.43. Accepted: 24.9.46.

Process for Drying Alcohol—Wet Polyvinyl Alcohol. To: E. I. Du Pont de Nemours and Co.

B.P. 580,910. Application date: 30.10.44. Convention date (U.S.A.): 29.10.43. Accepted: 24.9.46.

Improvements in and relating to the Manufacture of Catalyst Compositions and their Application in the Syntheses of Vinyl Fluorides. To: E. I. Du Pont de Nemours and Co.

Planned Mould Maintenance Service Aids Economical Production

Section XXI (contd.)

By W. M. HALLIDAY

In this instalment the author continues his discussion of the choice of mould lubricant. He then proceeds to the subject of heat diffusion in moulds of the injection type, sprue nozzle seatings, and bolt-fixing holes in the mould block.

AS will have been gathered from what has just been said, ordinary mineral oils are not of much use as lubricants for plastic moulds because of their tendency to rapid vapourizing, inability to maintain adequate oil film throughout continuous mould operation, and proclivity to carbonize excessively so as to form undesirable residues on the parts which should be lubricated or maintained free from corrosion.

Many mould engineers make up their own lubricants, these generally being mixtures of powdered graphite and light mineral oils, with admixture of plumbago, glycerine, or small amounts of vegetable oils. These home-made lubricants are certainly superior to straight mineral oils, but nevertheless do possess numerous disadvantages.

In the first instance, the powdered graphite employed is far from being fine graded enough to ensure complete solution with the liquid oil, or the formation of a complete graphited film over the affected part once the oil has been burnt up, or otherwise destroyed. The maintenance engineer will find, upon examining mould members lubricated by such mixtures, that after a time, instead of there being a uniform film of graphite over the whole surface of the part, the graphite tends to adhere to metal only in small patches, leaving blank areas, these latter being inadequately lubricated. This metal-to-metal contact will then speedily lead to increased friction and eventual seizure.

The second undesirability to be observed in respect of home-made lubricants is that they are rarely compounded in correct or identical proportions in successive preparations. Rule-of-thumb methods are almost always employed to determine quantities resulting in widely different grades of mixture, with consequent widely differing lubrication qualities.

A third drawback is the inability of such mixtures to maintain their original consistency over sufficiently long periods; hence wastage of material ensues and time is lost by the need for continually making up new supplies.

The fourth disadvantage is that these mixtures are generally unsuited for application by spraying, and in many mould mechanisms the ability to spray lubricant on to some inner surface often proves convenient, especially where a very dry lubricant is desirable to obviate contamination with plastic charge.

Another disadvantage possessed by such mixtures is they are poor heat conductors. This is an important requirement for plastic moulds used in the injection process. With these tools, securing correct thermal balance of the entire mould is very often a vital consideration, and mould lubricants can play an important role to attain such balance. Where the mechanism is complex, having numerous moving members, the amount of lubricant may be such that, given a poor conducting kind, certain portions of the mould surrounding those lubricated portions may retain too much heat and so the heat balance becomes upset and irregular.

An admirable lubricant for mould members is obtainable in the form of the now well-known colloidal graphite

"Oildag," produced by E. G. Acheson, Ltd. This is in highly concentrated form needing dilution before application. It consists of extremely fine dispersions of graphite microscopically graduated. Use of a carrying oil, preferably one of low carbon-forming nature, such as a light spindle oil, is recommended for diluting the paste to render it sufficiently mobile for applying to and coating a surface.

From experimental work it has been ascertained that surfaces treated with "Oildag," as previously mentioned, have a coefficient of static friction of only 0.16, which is extremely low in comparison with the coefficient of 0.5 for that of clean dry metallic surfaces in similar contact. As will be appreciated, this means much less force is required for commencing motions as the scale of frictional contact between surfaces engaged determines the amount of effort required to initiate movement over and above that to overcome normal inertia.

This is exceedingly advantageous to the mould designer since it enables quite complicated mechanisms to be used and operated as the load factor is appreciably reduced and less power is needed for starting movements.

Without entering into a precise and detailed technical discussion upon the chemical and physical properties and action of this proprietary compound, suffice it to mention here that the microscopically graduated particles or rather flakes of colloidal graphite are so minute that they very readily form a complete and uniform coating over any metallic surfaces thus treated, and will persist in adherence over lengthy periods even though the parts may be subjected to a considerable rotating or sliding action, or widely varying temperature changes.

By being mixed with light oil to any desired concentration the finished mixture may be made to a consistency suitable for either spraying, brushing or dipping on to surfaces with equal facility. In addition, as a dry lubricant it may be usefully employed in solutions containing only very small percentages of ordinary oil.

Use of this compound as far as plastic moulds is concerned will centre around such mould members as are here enumerated.

With a concentration of approximately one part of "Oildag" to 10 parts of light oil, a very suitable lubricant will be made for applying to screws, cores, core slides, locating pins, ejector rods, ejector rail guides, check screws for ejector, eccentrics, cam guides, and, indeed, any internal mechanism or screws, etc., which are likely to require removal from time to time.

If such parts as these are given a liberal and even coating with the "Oildag" during the last stages of assembly prior to commencing production, even though the need for removing them may be some months ahead, such operations will be greatly eased since the mixture will not only act as a lubricant but will also prevent corrosion between the surfaces intimately in contact.

This is a particularly beneficial feature for the maintenance tool makers because considerable time and trouble are thereby spared him when having to undertake the repair of a mould which necessitates stripping down certain parts.

In the case of slides, rollers, and guide bars, levers, etc., which may be externally situated on the mould, "Oildag" may also be usefully employed but in a less concentrated form. In these circumstances the writer has found the best results are obtained by making a number of sparse applications of the colloidal graphite mixture at fairly frequent intervals rather than to give a heavy or overliberal coating at the commencement of a production run and no further supply for a long interval of time. It has been found, too, that if the first two or three coatings are brushed, applied and then rubbed up immediately on becoming dry with a very soft cloth more lasting lubricating qualities will be obtained. By this means one imagines the finely dispersed graphite flakes become closely embedded into the grain of the metal, so enhancing the tenacity of the film.

In many plastic moulds, especially some of those employed in the injection process, it is often highly desirable that no liquid lubricant be employed so as to prevent its admixture with the molten plastic stream injected into the mould each shot. Often, when using liquid mineral oils, the heat from the moulds when at their working temperature causes a thinning of the oil, and also sets up a chemical action when brought into contact with the plastic material, which causes the latter to display puzzling variations, and the finished mouldings to be inferior in respect of some of their physical qualities.

Dry Lubrication

In such circumstances, the use of colloidal graphite, "Oildag," in practically undiluted form will be found a most effective way of overcoming the aforementioned troubles. The mixture is first applied to the various mould surfaces or members before the tool is placed in production, and several coatings are given, each one being well polished up with a cloth before the next is applied. Preferably, the tool or surface concerned should be warmed up. It is possible to obtain a surface having almost mirror-like polish and smoothness, having a "velvety" feel when lightly rubbed with the finger tips. The correct degree of coating may be determined by rubbing the clean finger tip lightly along the surface and upon removal should be faintly stained.

Such a coating will be found to stand up to a very considerable amount of movement even though the surfaces are subjected to heavy load, high speed, or varying temperatures. The maintenance engineer should carefully inspect such surfaces from day to day to observe break through of the film at any point. If such occurs to any appreciable extent a further coating or two in the manner performed initially should be made. Operators should also be forbidden to apply ordinary lubricants on to the affected parts if these are accessible.

"Oildag" has, of course, been extensively used in plastic moulding operations, chiefly as lubricant for the plungers and ram guides of compression presses, where it is preferable to have a lubricant of practically a dry character.

Application of Lubricants

In earlier sections the author discussed various interesting ways in which effective lubrication can be ensured in connection with both injection and compression mould members, but an additional word or two on the same subject will not be out of place or without interest at this point.

Indeed, the method of applying lubricant is equally as important as that of its selection, but, unfortunately, this aspect of design and construction very often gets overlooked and deferred until the mould is almost completed and then sometimes makeshift means have to be employed with correspondingly indifferent lubrication results. This, again, is the cause of much worry and additional work for the maintenance toolmaker charged with servicing the moulds.

In the first place, with regard to such mould parts as sliding cores, ejectors, slides, etc., wherever possible provisions should be made for small reservoirs of lubricant to be incorporated within their seating holes or guideways so that a constant supply of lubricant is available.

Provisions should also be made where such reservoirs can easily be fed with supplies of fresh lubricants from the outside of mould without having to dismantle same. Nothing proves more irritating to the maintenance engineer than to have to pull down an intricate mould mechanism merely in order to recharge a certain spot with fresh oil.

As far as possible it will also be advisable to equip such lubricant reservoirs with felt paddings, these initially being soaked well with the proper lubricant. Several advantages will be derived from this simple expedient. If the shaft slides or rotates within a hole thus provided, the felt pad will not only ensure that a sufficient coating of oil is always available for the shaft, but will also serve to wipe off any dirt, particles of dust, etc., so

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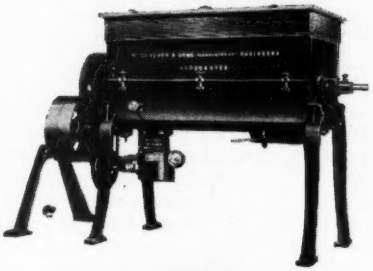

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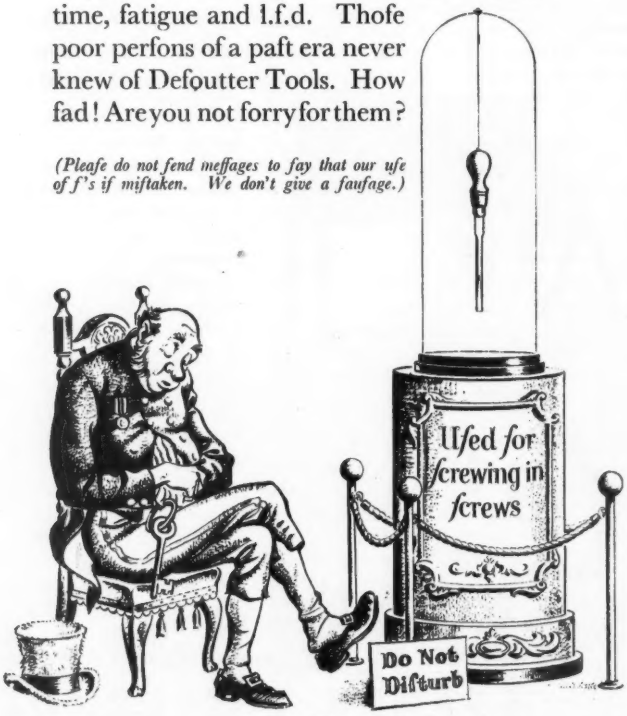

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keeping the shaft and bearing surfaces clean.

The feeding holes machined or piped through the mould to these reservoirs should be made as large as practicable to obviate the risks attendant upon blockage, as often occurs in the case of very small-diametered holes. The entry end of such holes should also be threaded to take stop plugs, or self-closing nipples, preferably those operated by means of a pressure oil-gun. This ensures absence of accidental contamination of the oil by dirt, etc., entering open-ended inlet holes.

Where lubrication is by means of ordinary lubricating oils as distinct from "Oildag," solutions previously recommended, the writer would not suggest the use of oil-grooving of the shaft or bearing surfaces of the parts concerned for the following reasons. Many oils employed carbonize extensively under certain heat conditions; this gives rise to hard, scaly deposits, which tend to adhere along any oil groovings cut in the parts, thus in time such grooves become totally blocked and the member ceases to receive the proper quantity of oil.

In such circumstances, the author would suggest the use of self-oiling bearing bushes, or, alternatively, the use of liners made from good-quality anti-friction metal, which would then greatly reduce the need for external lubrication.

Heat Diffusion in Moulds of Injection Type

One important aspect of moulding technique in respect of injection-type moulds is that of maintaining the correct heat balance over the whole surface of the mould. In earlier sections mention was made of the dual purpose which runners and gates may be made to serve in such moulds, viz., not only are they used for feeding material to the cavity area, but also to balance heat diffusion over the whole mould. This point is often overlooked at the designing stage, and maintenance toolmakers are thereby often caused innumerable operating difficulties and snags; also, undue quantities of faulty mouldings may result.

Runners should be so arranged as to equalize as near as possible mould heat. In other words, if the mould cavity covers a very large proportion of the surface area of the mould block, one small runner feeding in to one side of the cavity may be found totally inadequate as a means for equalizing mould-block temperature. In many such instances, the solution may only be reached by the provision of blind or dummy runners. Especially will these prove efficacious in cases where the normal feeding runner has to travel a long distance from sprue entry to cavity wall, and along one side only of the cavity. By using a dummy runner across the opposite side of block great improvements will often be secured.

The particular general attention entailed in respect of mould runners will be to ensure their freedom from dirt or adhering particles of solid plastic material. They should be examined once per week during each production run, and, if showing signs of dirt or bruises, these should be removed at once. Needless to say, all runner surfaces should be highly polished, and very often the maintenance toolmaker will deem it necessary to retouch up these portions so as to reduce friction of the flowing plastic stream and to reduce sticking. Watch should also be kept for undercut portions of the runner sides, which might be caused by a blow from some hard material. All cases of sticking runners should be reported at once; steel pins must not be used to pry out a sticking runner spray.

Very often it will be found that where the runner meets the mouth of the tapered sprue hole, the spray is weakened, due to the sharp corner at this junction. This will mean that sprue wastes will snap off from the runner, especially during the ejection stage, and may cause trouble by becoming jammed back into the sprue hole if the moulds are closed again without the operator noticing. The easiest way to avoid such troubles is to provide a slight radius at the junction of runner to sprue hole, so that this point is appreciably strengthened.

Some mould engineers adopt the expedient of overflow cavities of small volume as a means for ensuring sound mouldings, and also for restoring heat balance. These shallow cavities are usually disposed around the main cavity at judicious points and each is connected to the main cavity by a small runner. These runners tend to get blocked up from time to time and so defeating their object. It will be necessary for the mould maintenance engineer periodically to examine these and ensure all connecting runners are clear of dirt, excess plastic, carbon deposits from burnt-out lubricants, etc.

Sprue Nozzle Seatings

Yet another very essential maintenance requirement associated with injection moulds is that of effective nozzle sealing with mould block. Unless this is rigidly maintained in good condition many troubles will be caused.

All cylinder nozzle tips and semi-spherical seatings of mould blocks are subjected to very heavy pressure and wear and are very easily damaged by bruising due to incorrect alignments particularly during initial or new set-ups.

Any such wear, bruise, or adhering solid particles of metal or plastic may break the seal with the result that when an injection shot is made some may be squirted out of the ill-fitting portion of seating, being liable to cause injury to the operator, and at best leading to a loss of pressure behind the charge.

Special attention will have to be displayed by setters and the maintenance toolmaker to maintain all these surfaces in excellent condition, and at every setting-up some responsible person should be at hand to check up these points.

Damages, etc., are usually removed by setting-up the mould block, or detachable sprue bush therein, in the lathe to skim the affected surfaces. A similar corrective process is undertaken with respect to the cylinder nozzle tip.

In order to facilitate such correction operations by permitting them to be performed with the mould still in position on the machine the writer has developed a very simple form of reamering tool which can be easily made up in any toolroom from the following description.

It comprises a piece of cylindrical high-speed steel stock reduced down to a suitable smaller diameter for half its length, the end face of this small portion then being turned semi-spherical shape to exactly the same radius as that of the nozzle tip which has to seat in the bush or block. This end is next gashed so as to form six or eight shallow teeth, which are next suitably backed off and provided with cutting lands in the usual way with reamers. The larger diameter opposite end is recessed on its end face with a semi-spherical seating again to exactly the same dimensions as that of the nozzle tip bit in reverse form of course since this is a recess. Again a number of cutting teeth are formed in this recessed portion in the manner already described, with the exception that these teeth are formed so as to cut in the opposite direction to those at the male end of reamer.

The centre portion of the reamer shank is then either squared, or made hexagon shape to suit any convenient spanner size, whereby the reamer may easily be rotated when in use. The tool is hardened and the cutting teeth stoned to extreme sharpness and smoothness so as to produce very highly polished surfaces.

In using this reamer the mould block is first withdrawn a little on its guide-bars away from nozzle sufficient to allow the reamer to be admitted between. The male end of the reamer is then inserted into mould block seating and the recessed other end placed over the nozzle tip. The mould block is then held back towards the nozzle with a light but steady pressure and the reamer rotated a few turns with the spanner. This action will cause both ends of the tool to cut a fine shaving of metal from the respective surfaces engaged sufficient to correct these if out of true, or to remove any tiny damages, burrs, etc., which have been causing leakages.

The tool should be kept as short as possible and carefully stored when not in

use instead of being allowed to lie around the machine and so become damaged.

Its use imparts several advantages. Correction of both seating and nozzle can be accomplished at one movement and setting. The original spherical radius can be maintained over many years of mould usage, and very smooth surfaces can be secured with only a few minutes' application of the tool. A great amount of time normally required for dismantling the mould and removing it from the machine, and setting-up in the lathe, etc., is obviated entirely.

Bolt Fixing Holes in Blocks

Yet another very important point to be watched by the maintenance engineer as arising generally with all types and sizes of moulds is the condition of the fixing holes in the mould block whereby the tool is secured on the press or injection machine platens.

Where it is the practice to employ threaded holes very regular examination should be made of these to ensure that the threads have not become weakened or stripped. This latter feature often occurs since the heat of a mould causes considerable expansion of metal in block to take place after the moulds have been secured to machine. This means that generally an additional tightening up of screws will have to be made once the mould has been in use for a few hours. But the bolt, too, by this time will have become heated and expanded to some extent, so that, when contraction takes place when the mould cools, the bolts and threaded portions of the hole tend to become stretched, with the result that after a time the holes become distorted on the threads, or even have the latter stripped, especially at the mouth of holes, with resultant inadequate retention of mould.

The remedies for such damage are either to machine the holes deeper so as to form new proper size threaded portions, or else to enlarge them to the next size tapped hole, which will thus mean larger size bolts.

In the case of moulds attached to the platens by means of retaining ledges or steps machined along each side of the blocks and thus held down by means of a number of clamping plates gripped to platens by nuts on fixed threaded studs, or set screws, there is little that can go amiss except worn ledges. It sometimes happens that, on a mould which has been in use for a very long time and is of such a shape that the clamping straps can only be located at one point on the ledges, the surface and shape of these latter becomes badly worn and far from being flat. This will result in a very poor clamping pressure being obtained, since the strap will have a tendency to slide off the ledge. The remedy is obvious, but the main purpose of the maintenance engineer should be detection of such unsatisfactory features sufficiently early to prevent drastic or extensive re-machining of the mould ledges, or the provision of new clamps.

In moulds of this latter kind employed on very large scale production, but of such a kind necessitating numerous set-ups, the writer would urge the provision of specially hard facings to those spots on mould ledges immediately opposite the clamping straps so that these latter will bear upon the extra hard surfaces and so be less liable to wear or damage.

Clamping set screws must also be inspected from time to time to ensure they are not bent, strained, or stripped of threads at the vital points. In the case of new mould set-ups care should also be taken to make sure that such clamping screws are long enough to give adequate engagement and thus strength with the tapped holes in the block. In general engineering practice the usual rule is to make the bolt or screw to have not less than one and a half times its own diameter engagement in the tapped hole. In plastic moulding, however, the writer would urge that this ratio be increased to twice the diameter of screw. This gives much additional strength and safety.

Another useful point which, if attended to, will obviate numerous troubles is that of making some provision whereby all clamping bolts, straps, etc., needed for fastening a particular mould to the

machine platens can be attached to the mould when not in use and thus be stored with the tool.

If this is done the maintenance engineer will be spared many irritations of having to find bolts, studs, or straps when setting-up a mould again on the machine. Moreover, it will eliminate the danger of an uninitiated operator employing a wrong size bolt, etc., and so obtaining an insufficient grip on the mould.

The method employed by the author in this connection may prove helpful. In the case of large moulds on some unimportant external side a number of vee-shaped spring clips are fastened and into these may be clipped all pins, bolts, etc., when the tool is removed from the press. The complete set-up is then stored in that fashion. Some makers provide a number of tapped holes in the side of one of the mould blocks where their inclusion does not interfere with the working or the mould mechanism. The set screws and studs, etc., are then screwed tightly home into these holes when not required for holding the block on machine.

In the next portion of this section on toolroom methods and facilities the author will continue to deal with a number of general lines of procedure and also illustrate a number of extremely useful toolroom aids.

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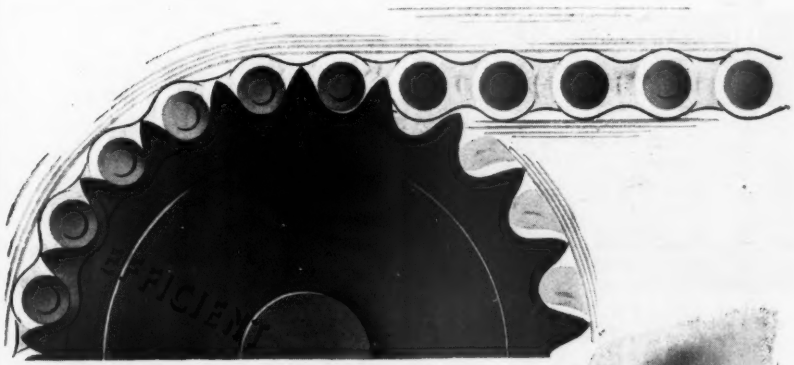

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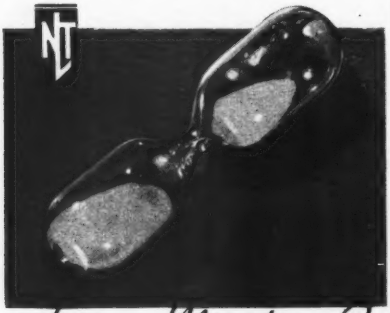

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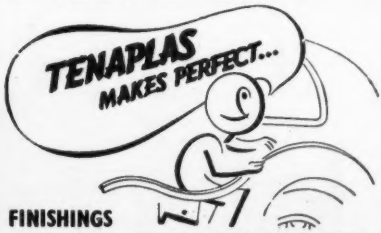

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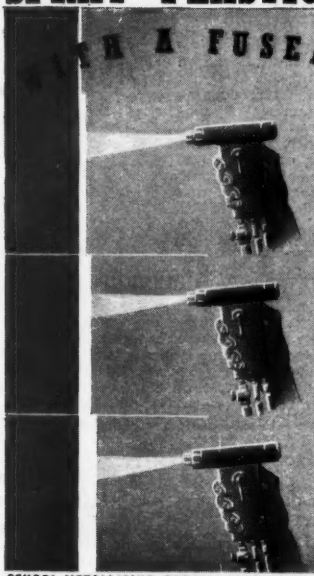

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AGENCIES

Agents wanted to go to the retail and making-up trades for plain and printed plastic material, rubber bathing caps and large range of novel plastic commodities. Apply Box 5896, care of "Plastics." 115-37

Agencies Wanted

Established firm of wholesale distributors, excellent connection southern counties, modern warehouse, wish to contact manufacturers of all types of plastics, either as agents or cash buyers. For further particulars write G. Parker, Cleasby Grange, Boscombe, Bournemouth. zzz-373

Export merchants, exporting to Europe, India and Africa, invite offers from manufacturers of plastic goods; large orders. Apply Box 4.., care of "Plastics." zzz-375

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REPUTABLE MANUFACTURERS
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ARRANGING WORLD AGENCIES.
Firms and actual buyers of repute only need apply.
Box 3989, care of "Plastics." zzz-378

Agencies Wanted (contd.)

How long will the sellers' market in South America go on? Just released Lt.-Col., aged 26, requires to contact progressive and far-sighted manufacturer-exporter of plastic goods with a view to representative's appointment in Argentina, where he intends to settle after necessary training time here. Capital available if required. Box 5802, care of "Plastics." 115-x5994

Active agent, with over 300 live accounts, calling on chemists and general merchants (wholesale only) in the North of England, Scotland and Northern Ireland, desires an extra line to carry with existing range. Commission basis. Write Box 5695, care of "Plastics." 115-x5646

Agencies wanted for the sale of plastic and Perspex articles. Offices operating from all large cities. Send particulars for cash on delivery to N. Gerver, Plastic Sales Dept., 2-10 Mare Street, Hackney, London, E.8. Phone, Amherst 5805 (five lines). 118-8708

Industrial Distributors (London), Ltd., 60 Fulham High Street, Fulham, London, S.W.6, London's most active domestic sales organization, with over 750 accounts in London alone, are now open to take on further domestic lines in plastic or otherwise, preferably new lines which require the benefit of modern sales promoters. 115-7

The Vulcan Trading Co., Ltd. (subsidiary of European International concern), with offices in Bombay, Calcutta, Madras, Karachi, Lahore, Bareilly and Rangoon, desire agencies and invite offers from manufacturers and exporters of all kinds of plastic goods. Write, V.T.C., care of Messrs. Trummer and Co. Successors, Ltd., 15 St. Helen's Place, London, E.C.3. 116-8705

Export firm, selling plastic goods of every description for over 20 years all over the world, with specialized agencies in every consumer country, invites manufacturers to an exchange of ideas for the creation of ideal export organization. We buy on own account, and/or act as export agents. Please write, Box 5886, care of "Plastics." 115-28

BUSINESSES, PREMISES, OFFICES, ETC.—Wanted

Workshop premises, 2-3,000 sq. ft., and safe storage for inflammables required London or suburbs. Box 5890, care of "Plastics." 115-32

DRAWING OFFICE EQUIPMENT

Uno Pen Stencils for quick and perfect lettering of plans and tracings. West and Partners, 36 Broadway, Westminster. 120-7071

FINANCIAL AND PARTNERSHIP

Shareholder is compelled to sell majority of his share in small moulding company. Excellent prospects. Probable minimum return next year £450. Write, Box 5927, care of "Plastics." 115-x6454

MACHINERY, TOOLS AND PLANT

150-ton downstroke hydraulic press, 10 ins. diameter ram, 2 ft. stroke, 4⅜ ins. diameter columns, 44 ins. daylight, table approximately 41 ins. by 33 ins., dummy table available. W.P. 2 tons to the sq. inch. Watchett Works, Oakhurst Road, Southend-on-Sea, Essex. 115-14

For Sale as New, one Fielding and Platt hydraulic pump, now motorized to give 11 gallons per minute at 1 ton pressure, maximum output 26 gallons per minute at 2-ton pressure, complete with oil storage tank and 20 h.p. motor and starter. What offers? Can be viewed at Maidenhead. Box 5881, care of "Plastics." 115-25

For Sale. Two Dowding and Doll hand injection moulding machines, automatic dosing device, automatic thermostat, 10 grammes wt. per shot.
One Francis Shaw ditto, as above, ¾ oz. per shot, mould available. Box 5885, care of "Plastics." 115-27

New hand hydraulic pumps, ⅝-in. plungers, 2-ton pressure, release valve, tank base, £15 each. Thompson and Son (Millwall), Ltd., Cuba Street, Millwall, London, E.14. 119-8460

New first-class 4½-in. four-impression gentleman's comb tool, £375. Box 5883, care of "Plastics." 116-8703

High Frequency sealing machine for sale, 200 watt output, suitable for welding P.V.C. and other thermoplastics; can be used for H.F. moulding; £100. Accessories available if required. For further details write: Industrial Research Corporation, 4 Pembroke Walk, Kensington, W.8. 117-x5841

Company disposing surplus machinery and stock, offers for sale Perspex sheets, coloured and clear. Black cellulose acetate compression moulding powder (2 cwt.). 40-ton downstroke Bakelite press with pumping unit. Bandsaw, jigsaw, flypress, drilling machines, laboratory press, buffing and lynishing machines, gas boiler, steam jacketed pans, steam piping and steam fittings. Box 5541, care of "Plastics." 115-x5158

Rediffusion RH2 250-watt high-frequency heater with separate matching unit and heating chamber, good condition. Offers invited. Box 5824, care of "Plastics." 115-x6050

Machinery, Tools and Plant (contd.)

Sale, Fibre-filler Cutting Machine. Ball bearings, six rotor and four stator knives, 18 ins. long, V rope drive, complete with 15 h.p. S.R. motor, 400/50-950 r.p.m., and starter. Sturtevant extractor and cyclone, spare set of knives. Box 5941, care of "Plastics." 115-44

Machinery, Tools and Plant Wanted

Three-throw horizontal or vertical pump wanted, 15 to 25 gallons per minute, 1½ tons pressure, new or good second-hand. Box 5884, care of "Plastics." 115-26

Required, any equipment for celluloid (sheets) machining, e.g., routers, saws, planners, cutting machines, etc.; also black dyes for rulers, set squares. Box 5892, care of "Plastics." 115-34

Krause or similar blocking machine urgently required. Box 5889, care of "Plastics." 115-31

PRODUCTION CAPACITY AVAILABLE AND WANTED

Pulverizing and grading of raw materials. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-369

Engraved name plates, scales, dials, etc., supplied. Tickets and Co., Silver Street, Leicester. Phone 21218. zzz-374

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Apply, Box 2405, care of "Plastics." zzz-383

Prompt delivery of compression and injection moulds. The Martin Supply Co. (Westcliff), Ltd., 488 London Road, Westcliff. Phone, Southend 3619. 115-9

Required, moulding capacity, preferably injection, for long runs up to three years. Apply, Box 36, care of "Plastics." zzz-376

Injection moulding capacity wanted with firms able to offer long runs. Several moulds available ranging from ¼ oz. to 3 oz. shots. Box 3397, care of "Plastics." 115-7311

Capacity for the design or manufacture of intricate moulding tools, repetition turning, springs and light presswork. The Super Ease Tool Co., Highfield Works, Oaklye Road, Redditch. 116-7670

Scrap Plastic. We buy fairly heavy type P.V.C. sheet off-cuts and cable strippings, Perspex, Polythene, Polystyrene, cellulose acetate and other thermoplastic scrap, if free from metal. All colours, sorted or unsorted. Send details, giving approximate weight and description, and if possible enclose sample. We will quote you on a single collection or contract basis, and if necessary send a representative to view the bulk. Write to Dept. P, Rubber Trading Co. (Kent), Ltd., 12 Piazza Chambers, Covent Garden, W.C.2. Phone, Temple Bar 4038. 115-7669

The Design Group, Ltd., can now accept assignments for the design of plastic products and components. Our production and tool-drawing office has a capacity of over 1,000 hrs. per week. Commonwealth House, W.C.1. Phone, Chancery 6451 (10 lines). 115-7891

Capacity will be available for plastic covering in colours and pastel shades, of such as hand wheels, hand rails and machine parts. Box 5917, care of "Plastics." 115-42

S. R. F. Freed, Ltd., of 27b High Street, South Norwood, S.E.25. Phone, Livingstone 4042. Have plastic material for sale, including Acetate, Casein and Perspex. 115-41

As raw materials are in short supply, make the best of your quota, for attractive design on plastical lines, consult Hart-Still and Associates, Industrial Designers, 880 Green Lanes, London, N.21. Laburnam 6121. 117-8830

Plastics moulding firm have press capacity and powder in various colours available for the production of high-grade phenolic mouldings from customers' tools. Also coloured urea powders for moulding for export only. Inquiries to Box 5928, care of "Plastics." 115-x6435

Wanted, quotations for machine turning of ebonite and plastic rod and tube. H. and Co., 8 Cool Oak Lane, Hendon, N.W.9. 115-x6360

Capacity Available. Short and medium runs for small injection mouldings; moulds made; also acetate fabricators. Inquiries invited. Box 5940, care of "Plastics." 115-43

Production Capacity Available and Wanted—(Contd.)

Immediate capacity for hand finishing and assembly work, colour filling, small injection mouldings, pressing from sheet, metal fastenings for costume jewellery, earrings, etc., supplied and assembled; 24-hour delivery service to London area. The Martin Supply Co. (Westcliff), Ltd., 488 London Road, Westcliff. Phone, Southend 3619. 115-8

Complete Consultative Service for plastic moulding production, embracing compression, injection and transfer techniques. Expert advice given on all phases of moulding production. Ideas and rough sketches converted to practical moulding propositions. Estimating, mould designing, and supply of fully dimensioned drawings now able to be taken on by a plastics engineer with 17 years' " know how " experience in the plastics industry. Box 5934, care of " Plastics." 115-x6356

Work wanted, tool room available for all sorts of press tools. Press work, assembling, spraying and all sorts of engineering to your design. Universal Components, Ltd., 19 Sunderland Terrace, W.2. Bay. 6776. 119-7900

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Repetition in Ebonite, Erinoid, etc. **Capstan** lathe work. Mansell, Temple Street, Rugby. 125-8451

Manufacturers of household articles and fancy goods are invited to send fullest details and samples to Major, Day and Co., Ltd., Wholesalers, 55-56 Western Road, Brighton, Sussex. 116-8455

For sale, Immediate delivery. Perspex off-cuts, coloured and clear, lactoid rods, and all forms of scrap plastic material available. Write J. E. Hoare, Byton Chambers, Amen Corner, S.W.17. 116-8456

Stockholding distributors with sales organization covering " The British Isles " are desirous of contacting manufacturers of high-quality plastic lines, moulded or fabricated. Full particulars. Box 13, Smith's Library, Andover, Hants. 115-8458

Moulding Capacity on 20-ton to 250-ton compression presses, offered to firms with own tools. Box 4978, care of " Plastics." 115-8065

Lactic Acid. Regular supplies of purified lactic acid required. Full details of quantities and specifications to Box 4976, care of " Plastics." 115-8064

London firm requires for home and export market plastics, household goods, including beakers, cups, saucers, plates, spoons, etc., in urea or phenol formaldehyde. Box 1427, care of " Plastics." 118-8062

Established Moulders (London area), with well-equipped finishing shop, are able to undertake deflashing, drilling, polishing, etc., of all types of mouldings. Box 5014, care of " Plastics." 115-8076

Pelleting. Capacity available for 1-in., 1¼-in. and 2¼-in. pellets. Inquiries invited for these and other sizes. Plastic and Chemical Products (Surbiton), Ltd., Elm Road, Hook, Surbiton. 115-8461

We are able to undertake certain small runs of plastic moulded products and individual plastic moulded products. Use our services for the preparation of prototypes in plastics. All inquiries strictly confidential. Cottrell and Co. (Plastic Section), 15-17 Charlotte Street, London, W.1. zzz-394

P.V.C. Compounds. Chips available in brown and black, first-grade quality. Apply East Anglia Chemical Co., Ltd., Street One, Aycliffe Trading Estate, near Darlington. 115-15

Beetle sheet, ivory, 25 ins. by 23 ins. by ⅛ in., 12 sheets, £14 14s.; 2 gallons Plastoglaze (air-drying), ivory, and 2 gallons primer, £7; 300 gross N.P. steel washers, ⅜ in. by 11-64 in. by 18 G., £10. Box 5878, care of " Plastics." 115-16

Plastic articles of all kinds required mainly for export. Continuity orders guaranteed for any lines selected. Box 5872, care of " Plastics." 115-17

For sale, clear Perspex, 5-32 and ¼ in., plasticized, paper covered, 1 sq. ft. sheets. Apply Box 5877, care of " Plastics." 115-20

New laminated sheeting, Bakelite, Ebonite and Tufnol, at bargain prices. Box 5876, care of " Plastics." 115-22

Quarter-inch coloured Perspex, all colours, size of sheets 24 ins. by 12 ins. Large quantities available. Box 5879, care of " Plastics." 115-23

Urea pastel shade powder, any quantity. Best prices paid. Box 5887, care of " Plastics." 115-29

Well-established wholesale business with connections throughout British Isles requires additional lines for New Year. Lines must be first class. Samples to Box 5888, care of " Plastics." 115-30

Production Capacity Available and Wanted—(Contd.)

West-End Wholesalers
(showrooms Oxford Circus),
with travellers all districts British Isles and connections with highest-class retailers everywhere, are eager to find new lines for all kinds of fancy goods, especially plastics, handbags, leather goods and novelties.
Would prefer goods for sole distribution.
Big turnover assured for right article. Highest references. Box 5230, care of " Plastics." 115-2

Celluloid sheets, 20/.000 ins. to 120/000 ins., required urgently. Box 5891, care of " Plastics." 115-33

For sale, quantities of fabric laminated plastic sheet, 38 ins. by 38 ins., ranging from ¼ in. to 1¼ in.; also ½ in. and 1½ in. and 13-16 in. paper based material and 3-16 in. by 7/8 in. and ½ in. by 36 ins. fabric dowel. Box 5897, care of " Plastics." 115-38

Cellulose Acetate sheeting, 3 mm. and 4 mm. clear, available in large sheets. Box 5875, care of " Plastics." 115-21

For sale, Bakelite knobs, 1¼-in. and 1½-in. diameter, with projecting aluminium rivet, attractive design, immediate delivery from stock. Write for samples and prices to Box 5373, care of " Plastics." 115-40

Required, regular supplies about 1 ton per month of solid organic waste with low ash and sulphur contents. Written replies, if possible with samples, to Box 5882, care of " Plastics." 117-8704

Stamping on plastic ware in gold and colours. Radio scales, clock dials, window display, etc. The Superb Stamping Co., 84 Highbury Park, London, N.5. Canonbury 1915. 115-x5993

Walnut shell powders, 100 mesh filler, with woodflour for phenolic, moulding powders. 325 mesh filler for synthetic glue. W. S. Dahl, 30 Stanley Road, Mortlake, London. Phone, 3791 Prospect. 115-6028

Unused moulds available for the production of luxury table lighters of novel design in plastic. £35. Inspection by appointment only. N. V. Tools, Queen's Road, Brentwood, Essex. 115-x5351

Advertisers offer, on alliance basis, sound, proved, permanent world-selling article, already manufactured in quantities in other materials less efficient than plastics. This proved market is offered on advantageous terms to plastic manufacturer with plant capable of initial tooling and subsequent manufacture of part of project in 6 to 12-oz. thermo-plastic injection mouldings. Box 5843, care of " Plastics." 115-x6178

Which moulder is interested to make best use of his urea supply by moulding expensive jewellery components from our existing tools, now or later. Box 5360, care of " Plastics." 115-5

Cartons.
We are large stockists of new and once used cartons. Once-used cartons in corrugated and fibre-board are carefully sorted and are in every respect equal to new. We would welcome your inquiries. List upon application.
Export cases.
We are able to make any quantity of export case. Delivery within 14 days of receipt of order. A sample case is dispatched before purchase, for test and inspection. For the home market we can make cases to your specification from seasoned converted timber without licence.
Wooden boxes measuring 21c by 12½ by 8 always in stock at 2s. 3d. each delivered London or F.O.R. Full tea chests 4s. 6d. each; half chests 3s. 6d. All clean and sound, coopered or uncoopered.
We can supply gummed tape up to three inches width, and can incorporate the trade mark of your company for a charge of 1s. per coil extra.
Large stocks of paper always in stock, and your inquiries are welcomed.
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If your problem is packing, consult the specialists.
W. Page and Sons, 34 Langside Crescent, Southgate, London, N.14. Phone, Palmers Green 5087.
Redundant cartons, in first-class condition, purchased for cash. 115-6

260 Tons of laminated sheets, from ⅛-in. to 2-in. thick in all grades, now in stock and available for the home market. We can provide immediate machining capacity including routers, millers, drills, cross-cuts, bandsaws, capstans and centre lathes, supported by an up-to-date tool room. Mica Products, Ltd., 1 Downs Park Road, Dalston, London, E.8. Phone, London Clissold 0524. 115-10

Capacity and material available for manipulated Perspex, clear or coloured sheet. Prototype work undertaken. Prompt personal attention and reliable deliveries. Plastic Developments Industrial, Ltd., 54 Snow Hill, Birmingham, 4. Central 5855. 115-13

SITUATIONS VACANT

West-End Manufacturers and Wholesalers, with special lines in high-class plastic, leather and fancy goods, require active and industrious representative with own car. If possible, introduced to London and South Coast stores. Advertisers already well connected with important stores in West End and suburbs, as well as South Coast. Accounts will be handed over and every support given to right man. Remuneration commission basis. Applications and references in full confidence to Box 5904, care of "Plastics." 115-1

Representative, with extensive connection among users of plain, printed, embossed and fabric-coated P.V.C. sheeting required; trial four weeks part-time on commission. Permanent situation if satisfactory. Apply, Box 4974, care of "Plastics." zzz-392

Toolmaker and Toolroom Turner required for plastic mould work. Must be fully conversant with this type of work, and only first-class men need apply; five-day week. Write, sending full details of past experience and wages required, to Watchett Works, Oakhurst Road, Southend-on-Sea, Essex. 116-8457

Shorthand Typists, Private Secretaries, Clerks, etc. If you are in urgent need of staff, contact Embassy Secretarial Employment Bureau, Excel House, Whitcomb Street, W.C.2. Whitehall 5924. We specialize in efficient personnel. 124-8069

Plastic Technician or Scientist capable of directing research and development required for the utilization of thermoplastic scrap, only applicants with practical experience and high qualifications, in particular with practical knowledge of American methods, need apply. Company wishing to engage applicant intends to reorganize and extend its plastic department and successful applicants would have substantial income, good prospects and permanent position. Box 5368, care of "Plastics." 116-8454

Chemist (qualified) for research on plastics required by well-known manufacturers near London. Experience in organic and physical chemistry preferred, but not essential. Permanent and progressive position with good salary and excellent prospects. State particulars of education, past experience, age and salary required. Strictest confidence assured. Box 5361, care of "Plastics." 115-8453

The Plastics Division of the Research Department of the Distillers Company, Ltd., requires several physical chemists, preferably with experience in physical-chemical research, for work on problems in the high polymer field. Remuneration commensurate with experience. Good prospects. Applications to Controller of Research and Development, Distillers Co., Ltd., Great Burgh, Epsom, Surrey. 115-11

Industrial Designer Wanted. Man of proved ability and experience required to take charge of newly opened Product Design Group in Midlands concern of good reputation. Write to Managing Director, giving fullest particulars of experience and outlook, and stating salary required, to Box 5873, care of "Plastics." 115-18

Progressive Company requires experienced foreman to take charge of toolroom (plastic moulds). Knowledge of press tools an advantage. Applicant must be able to furnish excellent references. Company at present in London, but will move to Midlands within three or four months. Permanent position and good salary with prospect of advancement for the right man. Only first-class men need apply. Write box 5874, care of "Plastics." 115-19

Maintenance Fitter wanted by plastic moulding concern, N.W.9 district. Must be fully conversant with hydraulics and electricity. Full details and references to Box 5880, care of "Plastics." 115-24

Progressive opening exists on production development work for young draughtsman (25-30). Jig and tool and plastic mould experience an advantage. Works apprenticeship or training essential. Peak district. Full particulars education and experience, to Box 5895, care of "Plastics." 115-36

Experienced mould maker required, medium-sized toolroom, S.W.8. Box 5942, care of "Plastics." 115-45

SITUATIONS WANTED

Sales Manager, insulating materials and plastics, A.M.I.Mech.E., A.M.I.E.E., Member Institute Plastics Industry, seeks change controlling indoor sales and outdoor technical representation; also has experience hydraulics, toolroom, heavy mechanical and electrical plant, research and staff control. Box 5894, care of "Plastics." 115-35

Industrial Research Chemist with high academic qualifications and considerable experience in research and development of synthetic resins and their intermediates, seeks position with participation in new processes developed. Box 5694, care of "Plastics." 115-x5650

Required, position as manager, or charge of plastics works, good technician, capable practical and theoretical worker. Box 5655, care of "Plastics." 115-x5527

Situations Wanted (contd.)

Plastic Technician having owned factory producing fabricated plastics desires position of responsibility; advertiser has extensive experience in designing of luxury articles and holds large contracts for these also in Continental cabinet fixtures and fittings, of which a complete range would be available. Box 5693, care of "Plastics." 115-x5658

Chief Draughtsman (Plastics), 15 years' experience in the design and manufacture of compression, transfer and injection moulding tools, is desirous of a change and wishes to take up employment with progressive firm. Box 5617, care of "Plastics." 115-x5409

Technical director of manufacturing company seeks position where all-round experience and abilities, plus specialized knowledge of moulding, will be suitably remunerated. England or abroad offers invited. Box 5926, care of "Plastics." 115-x6454

WANTED

Acetate and nitrate. Sheet off-cuts and scrap plastic materials of every description wanted. We can arrange collection. Top prices paid. Lloyd's, 72 Bridge Street, Christchurch, Hants. Phone, Christchurch 504. zzz-51

Wanted, Perspex sheet and off-cuts, clear and coloured. also casein rod. Box 5893, care of "Plastics." 115-39

School suppliers require Perspex sheeting cut to stock sizes for craftwork. Sizes required, 12 ins. by 6 ins., 12 ins. by 12 ins., in all thicknesses and colours up to ¼ in.; also wanted, job lots of sheeting, small or large amounts of coloured or clear Perspex off-cuts. Write, quoting details, to Box 5370, care of "Plastics." 116-8709

Scrap. Why not let a well-established firm quote you for cellulose acetate, Perspex, P.V.C. cuttings and other thermo-plastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plast.cs), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. zzz-395

Moulding Powder wanted for export, general-purpose phenolic. State specification, colour, etc. Box 5656, care of "Plastics." 117-x5602

Moulding Powders wanted, urea or phenolic, good prices paid. Box 5935, care of "Plastics." 115-x6367

Plasticizers. Job lots of the following required urgently: Di-methyl-glycol-phthalate, di-ethyl-phthalate, tri-cresyl-phosphate, tri-phenyl-phosphate. East Anglia Chemical Co., Ltd., Street One, Aycliffe Trading Estate, Near Darlington. 116-8831

Urea natural, cream, opal, wanted in exchange for pink, green, grey. Box 5358, care of "Plastics." 115-3

Urea urgently wanted. Any price paid. Box 5359, care of "Plastics." 115-4

MISCELLANEOUS

Monomarks. Permanent London address. Letters redirected, 5s. p.a. Write, Monomarks BM/MONO76, W.C.1. 116-7664

Extend Your Trade.
Use a Trade Mark. Consult
Trade Mark Protection Society,
12 Church Street, Liverpool. 118-6372

For sale, polythene strippings; black and tinted—white, segregated and cleaned ready for use. Box 4450, care of "Plastics."

For sale, P.V.C. strippings; black, yellow, brown—segregated and cleaned ready for use. Large quantities. Box 4449, care of "Plastics." zzz-389

Factory time recorders. Service rental. Phone, Vigilant 4731. Time Recorder Supply and Maintenance Co., 28 Mayfield Road, Sutton, Surrey. 125-8459

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